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First Annual Report

OF THE

ILLINOIS HIGHWAY COMMISSION

45188

FOR THE YEAR 1906.

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SPRINGFIELD, ILL.:
PHILLIPS BROS., STATE PRINTER
1907.

ILLINOIS HIGHWAY COMMISSION.

EDMUND J. JAMES, *Chairman,* Urbana.
JOSEPH R. FULKERSON, Jerseyville.
LAFAYETTE FUNK, Shirley.

A. N. JOHNSON, *State Engineer.*

LETTER OF TRANSMITTAL.

SPRINGFIELD, ILL., Jan. 1, 1907.

To the Governor of the State of Illinois:

SIR—We are transmitting to you herewith a copy of the first annual report of the State Highway Commission of Illinois.

It has been prepared by the State Engineer, Mr. A. N. Johnson.

On page 1 is printed a letter which was sent out by the State Highway Commission upon its organization in February, 1906.

We believe this report will show that the commission has been following out in good faith the program outlined in that letter. Its activity has been well within the authority conferred upon it by the Legislature in the Act creating the commission. It has had many and difficult problems to solve, which it has taken up with deliberation and earnestness.

Owing to various circumstances this commission was not constituted until the month of February, 1906. It was, of course, difficult to work out any comprehensive plan of action and carry it through within the ten or eleven months which have elapsed since that time.

We believe, however, that the record as given in this report will show that the commission has endeavored to carry out faithfully and conscientiously the duties imposed upon it by law.

The following pages contain a brief presentation of the more important features of our work.

TRAVEL STATISTICS.

The engineer of the commission is entitled to commendation for the collection of statistics as to the amount of travel upon rural roads. No similar data were ever collected in this country, and probably in no other country in the world except France. Such data are of interest and value in discussing any comprehensive system of road improvement, since the amount of use actually made of roads determines or justifies the expenditure for their maintenance or improvement.

EARTH ROAD IMPROVEMENT.

As earth roads constitute about 95 per cent of the roads of Illinois, it is certain that for an indefinite time to come the major part of the roads of the State will continue to have an earth surface. Anything that

can be done, therefore, to improve the surface of the earth road either by improvement in the construction or by improvements in the method of maintenance, is deserving of careful consideration. Immediately upon commencing active operations the commission gave its attention to this problem. It has published a bulletin on the road drag and through addresses by its engineer, has done all within its power to stimulate interest in the improvement of earth roads. The commission has authorized the preparation of a bulletin upon the construction and maintenance of earth roads which it is hoped will virtually become a text book to road officials and others interested in the betterment of the earth roads of the State.

Experimental Roads.

There has been a very sharp difference of opinion among the people of the State as to the possibility of constructing stone roads in certain portions of the State. It has been contended that the soil of the corn belt is so sticky that it will pull to pieces any broken stone road that can be constructed. It is certain that there is a very narrow margin between success and failure in this direction, and to determine the possibility of constructing broken stone roads in different parts of the State, the commission built through the past summer five pieces of experimental road, one near Salem in Marion county, one near Springfield, Sangamon county, one near McLean in McLean county, one near Greenville in Bond county, and one near DeKalb in DeKalb county. The success of these roads cannot be fully determined until they have stood the test of at least one or more winters.

There has also been a sharp difference of opinion as to the probable cost of broken stone roads in Illinois. The wildest kind of guessing and extravagant statements as to the cost of such work have been indulged in—one party claiming that good hard roads could be constructed for $1,500.00 per mile, the other party claiming that it would cost $10,000. The commission directed that every detail of the cost of the experimental roads should be kept, and it believes that the data on this subject presented in the report of the commission's engineer will be found very complete. We shall be able at no distant date to give very definite information as to the exact cost of any particular form of road construction under a given set of conditions. This will enable every road district to decide for itself upon intelligent grounds what kind of road construction it will undertake, or whether it will undertake any at all or not.

It will be seen from an examination of the report, that the cost of these experimental roads has been largely borne by the local communities, either directly through appropriations by road authorities or by subscriptions of private parties or both.

In addition to the stretches of road described above, several communities have put in, entirely at their own expense but under the supervision of the commission, several miles of road which, owing to the care exercised in construction and the accurate accounts kept of cost, may very properly be also classed as experimental roads.

The willingness of local communities to contribute such large sums publicly and privately toward purely experimental work, shows how deeply the general public is interested in finding out the exact facts as to forms and cost of highway construction.

Special Method of Construction.

The engineer of the commission has followed a somewhat unusual method for stone road construction which is worthy of note. The common method of building broken stone roads is to place the larger fragments at the bottom, the smaller next, and the screenings at the top. Mr. Johnson, our engineer, has partially reversed this. The only stone available in this State is soft limestone, and it is believed that by placing the smaller fragments at the bottom and the larger ones at the top with a thin covering of screenings to fill in the crevices a more durable road would be secured.

Expenditures on Roads and Bridges.

The commission may fairly claim that its present statistics on expenditures for roads and bridges are the most complete and most reliable ever collected for the State of Illinois.

Public attention should be directed to the fact that over four and a half millions of dollars were spent by the people of the State of Illinois in 1905 on roads and bridges. This is considerably over fifty dollars a mile. This great sum is expended by people who have made no study of the subject and have very little practice, and no scientific experience. That a large part of it should be wasted is inevitable under such conditions. The commission is doing all within its power to supply this deficiency of knowledge.

Local Expenditures Increasing.

Judging from similar data collected ten years ago for a single county, it appears that the local expenditures for roads and bridges are rapidly increasing in this State and it is very probable that they will continue to increase. If this be true, the need of thought and study upon the problems relating to roads and bridges, is certainly becoming greater with the passing years, and even if the expenditures are not increasing, the use of the road is, and thus the problem is of increasing concern.

Construction of Bridges.

The statistics of expenditures for roads and bridges above referred to show that the State is spending nearly two million of dollars per annum for bridges alone. A considerable portion of this is for new bridges. The commission has good reason for believing that many of the new steel bridges built in the State are unreasonably weak and excessively expensive. To remedy this the commission has offered the service of its engineer gratuitously to road officials, and it believes by so doing it has increased the strength of the bridges, and at the same time decreased the cost to a very material degree. The commission

has found a special desire on the part of road districts to secure competent advice as to the plans and construction of bridges. Indeed it is evident at present writing that if the commission were able to undertake all the work of this kind which local communities ask for, it would save to these communities within a single year many times the entire cost of the commission.

Distribution of Crushed Stone.

The commission has carried out as fully as was practicable the duty imposed upon it by law of distributing crushed stone from the penitentiaries to the road districts desiring the same. Some of the railroads have been willing to accept the crushed stone in payment of freight charges. All the leading railroads have coöperated in giving a uniform rate for crushed stone used in the construction or improvement of highways.

The demand for crushed stone wherever railroads are willing to deliver it in return for crushed stone, that is where it is practically furnished to the communities free of charge, has far outrun all the possibilities of the penitentiaries or railroads to supply it. Furthermore, many communities are eager to pay freight charges if the distance from the penitentiary is not too great, in order to get such crushed stone. There is little doubt that as the railroads show a greater willingness to carry this stone in return for crushed stone, or as they find it possible to lower the cash rate, the demand for such crushed stone will increase continuously and rapidly. It was found necessary to install additional crushers, as will be seen from the report.

Defective Law.

The bridge work of the commission is hampered somewhat by a law now upon the statute books of Illinois, intended to govern the strength of highway bridges. Article 275 of chapter 121 of the Revised Statutes, p. 1631 of Hurd's 1903 revision, in almost so many words says that it shall be unlawful to build a highway bridge having a smaller capacity than 100 pounds per sq. ft. Article 276 says that the penalty for each violation of this law shall be $200. The commission is reliably informed that this law gives an unjustifiable feeling of security to the public and to the road officials. Competent engineers advise us that the technical feature of the law is absurd in its indefiniteness, and further that it is insufficient for short spans and extravagant for long ones. The law is ineffective in that it is not clear as to who shall be fined, the contractor who builds the bridge, or the official who buys the bridge, or the engineer who designs the bridge. The commission is of the opinion that a law should be passed giving some competent State authority the power to approve all plans for bridges over a certain length of span costing more than a certain sum. Of course it will be necessary to provide adequately for the expenses incident to such compulsory functions.

Summary.

The work of the commission may be summarized in the following paragraphs:

It has collected, first of all, a mass of valuable information concerning the actual condition of highways and bridges in the State of Illinois and the use of the same which may serve as a basis for the future action of this or succeeding commissions.

It has collected in a convenient form and distributed to the various road districts in the State information bearing upon the construction and the proper care of earth roads, which form the major part of the road mileage of this State.

It has undertaken to determine the conditions under which earth roads may be improved, and the cost of the same.

It has collected information upon other kinds of roads built and maintained by the various road districts of this State, including gravel, macadam and brick.

It has begun experimentation with these and other materials for road building, trying to ascertain as far as possible the facts in regard to the usability of the various materials for road construction found within the limits of the State.

It has distributed the stone prepared at the crushers in the State penitentiaries as far as it was found possible to do so, to the various road districts in the State which applied for such stone.

It has secured and published special rates from the railroads of the State for the hauling of crushed stone for use on the public highways.

It has given information to the officials of the various road districts who may have applied to it for assistance in the matter of bridges.

The chief function of the commission, then, aside from the distribution of crushed stone, may be briefly defined as the collection and dissemination of existing information and the increase of our knowledge of road and bridge building by actual, scientific experimentation. To judge from the inquiries which have come to the commission from every part of the State since its work has begun, there is a much larger demand for this information and a much greater willingness to utilize it for the improvement of road and bridge conditions, than anyone could have anticipated.

All of which is respectfully submitted.

Edmund J. James, *Chairman,*
Joseph R. Fulkerson,
LaFayette Funk.

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LAW ESTABLISHING A STATE HIGHWAY COMMISSION.

[*Passed by the Forty-fourth General Assembly.*]

AN ACT *to establish a State Highway Commission, defining the duties thereof and to make an appropriation for experimental purposes.*

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That the Governor shall, upon the taking effect of this act, by and with the consent of the Senate, appoint three persons, to be entitled and known as "The Highway Commission," two of whom shall belong to the political party casting the highest number of votes at the last preceding general election and one of whom shall belong to the political party casting the next highest number of votes. The persons so appointed shall hold office for two years from the date of their appointment and qualification, unless sooner removed. In making the appointments the Governor shall designate which of the three persons so appointed shall act as chairman of the commission for the ensuing two years. In case of any vacancy in said commission, the Governor shall immediately fill such vacancy. The Governor may remove any member of said commission from office for misconduct, incompetency, or neglect of duty; and two members of said commission shall constitute a quorum for the transaction of business.

§ 2. Before entering upon their duties, the said commissioners shall respectively take, and subscribe to, the constitutional oath required of other State officers, which shall be filed in the office of the Secretary of State, who is hereby authorized and directed to administer such oath. The Secretary of State shall thereupon set apart and properly furnish a room in the State Capitol for the use of said commission and shall provide all needful books, stationery and printing required for the transaction of the business of the commission. The said commission shall submit an annual report to the Governor, which shall include a detailed statement of the expenses of the commission.

§ 3. It shall be the duty of the commission to investigate and to carry on such experimental work in road building, different methods of construction, kinds of material and system of drainage as will enable it to determine upon the various methods of road construction best adapted to the various sections and soils of the State, the cost of the same, and recommend standards for the construction of highways

in the various sections of this State. It may be consulted by county, city, village or township officers having authority over highways and bridges and shall, when requested, advise and give without charge information to such officers relative to the construction, repairing, alteration and maintenance of said highways and bridges.

§ 4. The said commissioners shall receive no compensation for their time or services; but the actual expenses of each of them while engaged in the performance of the duties of the office and any actual outlay for any aid and assistance required in examination and investigation, on being made out and certified by the commissioners making the charge, verified by the chairman of the commission and approved by the Governor, shall be paid monthly by the Treasurer, on the warrant of the Auditor of Public Accounts.

§ 5. The said commission shall have power to appoint a State engineer, who shall receive reasonable compensation for the time actually employed in the service of the State. Said engineer shall be subject to the direction of the commission while engaged in his official duties and shall be allowed his actual traveling expenses when on official business. He shall submit an itemized statement of his expenses to the commission for their approval. Said commission shall be empowered to employ such clerical and other assistance as the members thereof may deem necessary to successfully carry on the work of said commission.

§ 6. It is hereby made the duty of all commissioners of highways in counties under township organization, and of commissioners of highways and supervisors or overseers of highways in counties not under township organization, to furnish detailed information concerning their work and of the highways under their control to the State Board of Highway Commissioners, upon the written request of and on blank forms supplied by said State Commissioners.

§ 7. The sum of twenty-five thousand dollars ($25,000) per annum is hereby appropriated to carry out the provisions of this act and the Auditor of Public Accounts is hereby authorized and directed to draw his warrant for the sum herein specified upon the Treasurer upon the presentation of proper vouchers attested by the chairman of the commission and approved by the Governor.

Approved May 18, 1905.

SPRINGFIELD, ILL., Dec. 31, 1906.

To the Honorable Board of State Highway Commissioners, Springfield, Illinois:

GENTLEMEN—I beg to submit herewith my report as Engineer to the Commission for the year 1906.

Very respectfully,

A. N. JOHNSON,

State Engineer.

INTRODUCTION.

The work of the State Highway Commission divides itself naturally into three main divisions: (1) Scientific and practical investigation; (2) the collection of information as to existing conditions; (3) the dissemination of such information.

Much investigation has been undertaken and a close study made of existing methods and conditions which have a bearing on the upkeep and improvement of the public highways of the State.

Many requests have been received for information about road building and road improvement from public officials, farmers' institutes and other organizations, as well as private individuals. In all discussions of highway problems, the value of practical demonstration has been given first place, and such demonstration made and urged in every instance possible. The result of this work has been the conviction that far better results can be obtained than at present without any increase in the tax rate.

In some sections a total misconception existed as to what the State Highway Commission could and would accomplish. Through the ill advised efforts of many people there has arisen the idea that road improvement and the construction at a large cost of macadam or so-called "hard" roads were synonomous. Many of these agitators had outlined a plan of work, the logical end of which meant the expensive improvement of all the roads in all communities. It was evident that such a plan was impracticable and unnecessary to meet the conditions that exist in Illinois, and for that matter, in most other states as well. The result has been widespread misinformation as to road improvement in general, and, in some communities, a total misunderstanding of the general plans of the State Highway Commission.

The first step necessary was to correct this false impression and to make known as widely as possible the commission's program. Accordingly, an open letter addressed to the people of Illinois was issued, the text of which is here given in full:

OPEN LETTER TO THE PEOPLE OF ILLINOIS.

To the People of the State of Illinois:

FELLOW CITIZENS—The General Assembly of the State of Illinois at its last session, passed a law creating a State Highway Commission. Under that law the Governor of the State has appointed the undersigned members of this commission.

As there seem to be various misconceptions as to the purpose and functions of the commission, we have deemed it advisable to issue the following statement, to which we invite your careful attention:

It will be noted that the commission is not called in the law a hard roads commission, or even a good roads commission, but simply a highway commission. This name, we believe, to be significant and to indicate in general its function.

We enter upon this work without preconceived notions or pre-determined policies. It is not made our function by law, nor it is our intention to urge upon the people of this State, or upon those of any section, any special policy as to their respective highways. The determination of the road policy of this commonwealth is vested by law in the public officials of the county, township and road districts, and it is not our duty and is far from our desire to attempt to dictate to any of these officers as to any point respecting their highway policy. In a word, it is not the function or purpose of this Highway Commission or of any of its members to make propaganda for hard roads or State aid in any form. On the other hand, it is made our duty and will be our desire to be of any use or assistance in our power to any or all of the road officials of this State in the performance of their respective duties. It is our purpose to put all the forces of the commission at the disposal of such officials and to serve them in any way we can.

Over ninety-seven per cent of the actual highway mileage of the State is earth road, which, for aught we can see, will be for generations to come the prevailing type of roadway. It will be our effort, therefore, to make such a study of the construction, care and improvement of these roads as will yield valuable results for the benefit of every portion of the State, keeping in mind the fact that the improvement of these roads benefits immediately all classes of the community and every part of the State alike.

In some portions of the State the local authorities are constructing gravel and macadam roads. We shall try to offer to these sections of the State such assistance in the way of advice as we may be able, by drawing up standard specifications, testing the quality of road-building material and finding deposits of material which may be of use in such road construction. In the last mentioned task we have been promised the aid of the State Geological Survey. We shall thus hope to make some valuable contributions to this style of road-building wherever local authorities desire and local conditions justify it.

We hope further to be of assistance to all departments of the State alike in furnishing on request, advice and specifications as to bridges, culverts, and other forms of structure necessary to highway maintenance. We shall aim to develop an engineering force of such character and training as will put at the disposal of the poorest road district in the State the best possible expert advice as to all matters falling within its jurisdiction. So that upon questions of grade, drainage, culvert and bridge construction the roadmasters of any district or the highway commissioners of any township or the authorities of any county may obtain, upon request, the best advice we can furnish.

The law makes it our duty to collect and publish full statistics relating to the highways of the State, and makes it the duty of local officials to give us the necessary information upon blanks furnished them for this purpose. We make an urgent appeal, therefore, to all road officials to assist us in the performance of this portion of our duty.

The law of the State relating to the employment of convict labor in our State penitentiaries makes it the duty of the boards of management of these institutions to furnish to the highway commission such quantities of broken stone as it may call for—this stone to be of a size and quality suitable for use in highway construction. The State Highway Commission is authorized by law to distribute this stone among those road districts of the State asking for it free of all charge to these districts so far as the railways of the State are willing to carry such stone in return for similar stone to be used by them. The quantity of such stone available is, of course, limited, and it will be distributed in accordance with general regulations intended to insure fairness in distribution among those communities asking for it.

The penitentiaries are also required to manufacture tile suitable for road drainage, and road machinery which will be distributed in the same way. But at present no penitentiary has actually installed a plant for manufacturing such tile. Due notice will be given to the road officers in the State when and where such tile and road machinery can be obtained.

It is further made the duty of the highway commission to undertake a careful and thorough examination into the best and cheapest method of highway construction adapted to the needs and conditions of the various portions of the State. Accordingly we shall begin a system of experimentation in the construction, maintenance and improvement of all classes of road which seem adapted to the peculiar conditions of any portion of the State. The coöperation of the highway department of the State University in charge of Professor Ira O. Baker, has been secured for this part of our work and we shall hope to have some valuable results in course of time from this department of our undertaking.

The headquarters of the commission will be in the State Capitol at Springfield, to which all communications should be addressed.

As State highway engineer, the commission has engaged the services of Mr. A. N. Johnson, for some time in charge of the highway division in the United States Department of Agriculture at Washington. As one experienced in this sort of work in different parts of the country, his acquaintance with the construction and improvement of earth roads, his careful training as a civil engineer, his knowledge of building all forms of modern highways, will, it is believed, stand the people of this State in good stead. He will be assisted by a competent corps of engineers which will be increased as the public demand may make necessary.

It is plain that the success of this Highway Commission is absolutely dependent upon the hearty coöperation of county, township and district officials, and we earnestly bespeak such coöperation and support, so that by the combined efforts of State and local officers in this department of public administration the interests of the people of this commonwealth may be most fully served.

EDMUND J. JAMES,
JOSEPH R. FULKERSON,
LAFAYETTE FUNK,
State Highway Commission.

In addition to the distribution of circulars, the plans and the work of the commission were explained and discussed in detail wherever public meetings were attended, and when fully understood met, almost without exception, general approval. The shortness of time and the great area to be covered has necessarily left many sections of the State unvisited and still in doubt as to what the State Highway Commission will and can accomplish. But whatever may be the opinion as to the value of the work the State Highway Commission can render, it is generally conceded by all that the condition of the roads is bad and that their improvement is a desirable thing, particularly if the improvement can be made in an inexpensive manner.

Accurate information has been collected regarding the condition of the roads in all parts of the State. Early in the spring there was sent to all the highway commissioners throughout the State a set of questions regarding road expenditures. To all of the rural letter carriers another set of questions was submitted as to the condition of the roads which they daily traverse.

The result of a vast amount of information collected from a great many sources, other than those already mentioned, confirms the somewhat general opinion that there is a great yearly waste of money in so-called road work.

The total cost to the tax payers in the rural communities for roads and bridges in 1905 was $4,625,365. In Table 1 will be found a detailed statement showing how this sum is distributed among the different counties and the various items which contribute to this large total.

It is not an extravagant estimate to say that at least half of the money value of the work done on the roads is practically wasted. The first logical step, therefore, in any plan of road improvement under such conditions is to find out by what method better results may be obtained with the money that taxpayers now spend and then, which is quite as important, to make these methods known and have them used.

As is well known, the great majority of the roads of this State is earth roads. Particular attention has, therefore, been paid to the proper method of maintenance of earth roads and to put these methods into practical operation. A bulletin on the earth road drag was published and some 25,000 copies distributed throughout the State. In addition, many newspapers published the text of this bulletin in full, so that there are few localities in the State where the use of the road drag is not known.

In every township of the State bridges have to be maintained and over 45 per cent of the money tax, or $1,888,724, raised yearly for roads and bridges is paid for highway bridge construction. In the construction of these bridges there has evidently been much waste and high prices paid for poor structures. In many cases structures have been erected that are absolutely unsafe. Here, then, was open another field for the State Highway Commission to investigate and to render assistance to local road authorities in the preparation of proper plans and estimates for bridge work. The results so far show that in most instances better bridges can be erected at no greater cost than heretofore, when the work is handled in a thoroughly businesslike way. A criticism that can be made of the road work in general is the lack of proper business management; not so much through the fault of the individual road officials as through the system of road administration that has been gradually built up.

The work undertaken by the commission has not rested with the finding out and suggesting various methods of road improvement. It has been the aim to demonstrate practically how better results could be obtained; whether it was in the construction and maintenance of earth roads, or macadam roads, or in the construction of highway bridges. No more forceful argument can be presented to a community than that shown by a practical object lesson. If there are but a few miles of earth roads that are kept dragged, or but one permanent culvert or bridge erected, or a short piece of road macadamized, it is sufficient to excite the desire in that community to have the condition of all other roads, bridges, and culverts bettered. It invariably has been the result everywhere that although the object lesson by itself may be of small consequence, its results are wide reaching.

The other phases of the work of the State Highway Commission includes the establishment of special freight rates for the transportation of road material prepared at the penitentiaries.

A road traffic census has been undertaken, and it is believed particular interest will attach to the statistics which have been gathered, as it is the first time, so far as known, that a systematic census of road traffic has ever been carried out in this country. It is proposed to continue this work during the ensuing year and to increase the number of stations so that the resulting statistics can be reasonably conclusive from any point of view that they may be studied.

In addition to the application of well known methods of construction to the various conditions presented, it is the intention to experiment with new and untried methods of road building, particularly to develop if possible an improved method to render the upper surface of earth roads waterproof. A number of experiments along this line has been planned, but the shortness of the time and the large amount of other work necessary to be done have not permitted conclusive deductions to be made.

PRESENT METHOD OF ROAD ADMINISTRATION.

A brief outline of the method of road administration in the State is given as a preface to the understanding of statistics and other information concerning the public roads herein contained.

Township Organization.

Administration of public road and bridge work in Illinois is intrusted to the townships, except in a few counties. There are two distinct organizations of county government; township government, which embraces all but nineteen counties in the State, and county government, including those not under township organization. Under township organization there are elected in each township three highway commissioners who form a distinct corporate body having direct jurisdiction over the public roads in their township. The boundaries of the townships correspond somewhat closely with the township boundaries of the United States public land surveys. In counties not under township organization, the county is divided into road districts for which three road commissioners are elected. Thus there is little difference from actual township organization so far as the general administration of road matters is concerned.

The affairs of a county under township organization are controlled by a board of supervisors, at least one elected from each township; while in counties not under township organization county business is transacted by a board of three commissioners. The people of any county may at their pleasure, as expressed at a properly held election, decide to have or not to have a township organization.

Each township in counties under township organization, or road districts in counties not under township organization, is divided into three sub-districts from each of which a highway commissioner is elected. The road work in a district is under the particular commissioner from that district, so that, aside from the allotment of funds to the district, the highway commissioners usually have little to do with road interests outside their own districts. It is possible to find in the same township three different methods of road work with perhaps good results in one instance and bad in another. Thus, one-third of a township, in consequence of the bad methods of a commissioner, may get little or nothing of value done to its roads. Although a corporate unit, the commissioners carry on the work as three units.

The commissioners are allowed by law $2.00 per day for each day of actual service. There in all 4,839 commissioners in the State and 94,141 miles of public roads, which is an average of 19.5 miles to a commissioner. When the commissioners hold meetings, each day spent to decide about a bridge, to hold a bridge letting, to award the contract, or accept the same, costs the township $6.00 for the administrative duties, and in too many instances the administrative expenses constitute too large a per cent of the money that a township has to spend.

Cash System.

The work on the roads is paid for by taxation under two systems, the cash system and the labor system. When all the road taxes are collected in cash the highway commissioners estimate the amount of money required and the rate of tax necessary, which shall not exceed 60 cents on the $100.00 except in cases of special emergency when the highway commissioners may levy an additional 40 cents with the consent of the town assessor and board of auditors. All taxes collected for highway purposes are paid to the treasurer of the highway commissioners and in turn are paid out by him on the order of the board. A poll tax of not less than $1.00 and not to exceed $2.00 may also be assessed for highway purposes.

Labor System.

Townships in counties under township organization may by vote at a special town meeting adopt what is known as the labor system. Under the labor system all road tax against any property and all poll taxes may be paid in labor on the public roads. In addition to the labor tax which is assessed against all property the highway commissioners may assess a cash tax not to exceed 40 cents on the $100.00, to be used in the repair and construction of bridges, for opening new roads, and for the purchase of road machinery. The township is then divided into a number of road districts and a road overseer appointed in each district by the commissioners. The overseer must attend to all the highways in his district and keep a record of all work performed in payment of taxes, as well as have a record showing the amount of taxes due from everyone in his district. Persons assessed labor tax may at their option pay the same to the overseer in money which is expended by him in work on the highways in the district in which the tax is assessed.

The law requires special duties of the overseer and makes it an office of considerable responsibility. It also provides that the compensation of the overseer shall be at the rate of $1.25 a day. Although there is nothing in the law to prevent a higher salary to the overseers, the fact that a rate of $1.25 a day is mentioned limits in most instances the pay offered. As might be expected, in view of the salary allowed, it is difficult to get a man to serve as overseer, and the class of men it is desirable to have cannot afford to give their time to this work. It is a notorious fact that work done on roads in payment of labor tax is not full value of the tax, and oftentimes the overseer puts

in more time getting two or three men to come to work on the roads than the actual amount of labor performed amounts to. Although the law provides that work shall be done when demanded by the overseer, as a matter of fact the enforcement of the law is almost impossible, or at least in practice is not carried out, with the result that the greater portion of the work on the roads is done at the convenience of the persons assessed for labor tax.

It frequently happens that a man informs the overseer that he is ready to bring his teams and man on the road to work out his tax and that he can do it on such and such a day, otherwise he is uncertain when he can do any work. The overseer finds some work for the men to do, and so long as some disturbance in the road surface is made, presumably to give physical evidence of the labor performed, the man's tax is considered "worked out." At other times the work is done and the overseer informed that such and such work has been done. Practically in all these cases, granting that the work was done properly and at the proper time, the amount of work which is reckoned as a day's work is considerably less than the same amount of work these teams and men would perform for private hire. Probably the worst feature of the labor system is the practical non-enforcement of the provisions of the law, which breeds a certain contempt for the law which is thoroughly bad in its effect.

Special Bridge Tax.

In addition to the taxes raised in a township or road district for highway work, the law provides that a county, whether under township organization or not, may assist the townships or road districts in the construction of intertown or other important and large bridges which are of benefit to other than the residents of the town in which the bridge is located. The county may also give money towards the construction of the more important roads. Money thus received from the county by the towns is termed county aid.

Special Tax for Macadam Roads.

Additional funds for the building of macadam and gravel roads may be raised as follows by the townships and road districts: If the majority of the voters of a township or road district have so voted, a special tax may be levied not to exceed $1.00 on the $100.00 of all the taxable property. The revenue thus secured can be spent only on one or two specially designated roads. The vote on the tax shall state how many years, not exceeding five, it is to be levied.

County Organization.

It will be observed there is little difference between the management of the roads in counties under township organization and counties not under township organization, except where the labor system has been adopted. In one case the county is divided into townships, and in the other into road districts. Both may receive county aid or levy additional tax for special road improvement.

But there is one very important difference. In counties not under township organization it is provided by an Act passed in 1901 that the voters of the county may elect to place the road administration of the whole county under the board of county commissioners, doing away with separate corporate road districts with three highway commissioners in each. This law at present offers the only possible opportunity to place the road work on an economical business basis, although it is more or less nullified in that it provides for the establishment of the labor system. Henderson and Union are the only counties, so far as could be ascertained, to adopt this method of road administration.

The county unit is usually large enough to warrant the employment of a competent highway engineer to have immediate control of all road work. While it is true that there is a chance for greater economy by combining a number of small units, there is also a chance for greater extravagance by mismanagement, but larger public interests than the highway affairs of a single county have been economically administered and under township administration as at present organized there is not the same opportunity for an equally economic road administration.

EXPENDITURES FOR PUBLIC ROADS AND BRIDGES.

The law requires that the State Highway Commission shall report as to present methods and expenditures on the public highways in the State, addressing for this purpose questions to the various township or road district commissioners. The following list of questions was, therefore, sent to the highway commissioners of the 1,379 townships in counties under township organization and to the highway officials of 234 road districts in counties not under township organization:

QUESTIONS ADDRESSED TO THE TOWNSHIP COMMISSIONERS OF HIGHWAYS BY THE STATE HIGHWAY COMMISSION.

1. How many miles of country roads in your township and along the east and south boundary lines? (Do not include any streets in cities, towns and villages, or roads along the north or west boundary lines of township.)
2. (a) How many miles of earth roads are shaped or crowned?
   (b) How many miles have been surfaced with gravel?
   (c) How many miles have been surfaced with crushed stone?
3. Is the general character of the roads of your township "level," "rolling," or "hilly?"
3. Is the soil of your township black loam, clay, or sandy, etc.? If more than one kind, state about the proportion of each.
5. How many miles of road in your township are underdrained with tile? Is the tile commonly laid on one or both sides of the road?
6. List as indicated in the form below, the implements owned by your township.
7. List as indicated in the form below, the implements owned in your township by cities, towns or private parties.
8. What native material exists in your township, suitable for use in surfacing roads? If stone is found mention kind. Also describe the character of the gravel, if any exists. State in what quantity each exists, as regards the demand for such surfacing material on roads in your township, using the terms "limited," "sufficient," "abundant." Give cost per cubic yard of gravel at pit, and of crushed stone per cubic yard at crusher.

Answer the question under No. 8 in the form below:

9. If no road surfacing exists in your township, state nearest source or sources of supply, and what material can be secured there.
10. (a) During what months is most of the work on the dirt roads done?
    (b) Are the side ditches and culverts kept clean throughout the year?
    (c) Are the roads "crowned up," so as to offer a quick escape for water?
    (d) Are the weeds along the road mowed, and how often?
11. (a) What is the average depth of gravel on your gravel roads?
    (b) What is the average depth of stone on your crushed stone roads?
    (c) What is the average width you spread gravel on your roads?
    (d) What is the average width you spread stone on your roads?

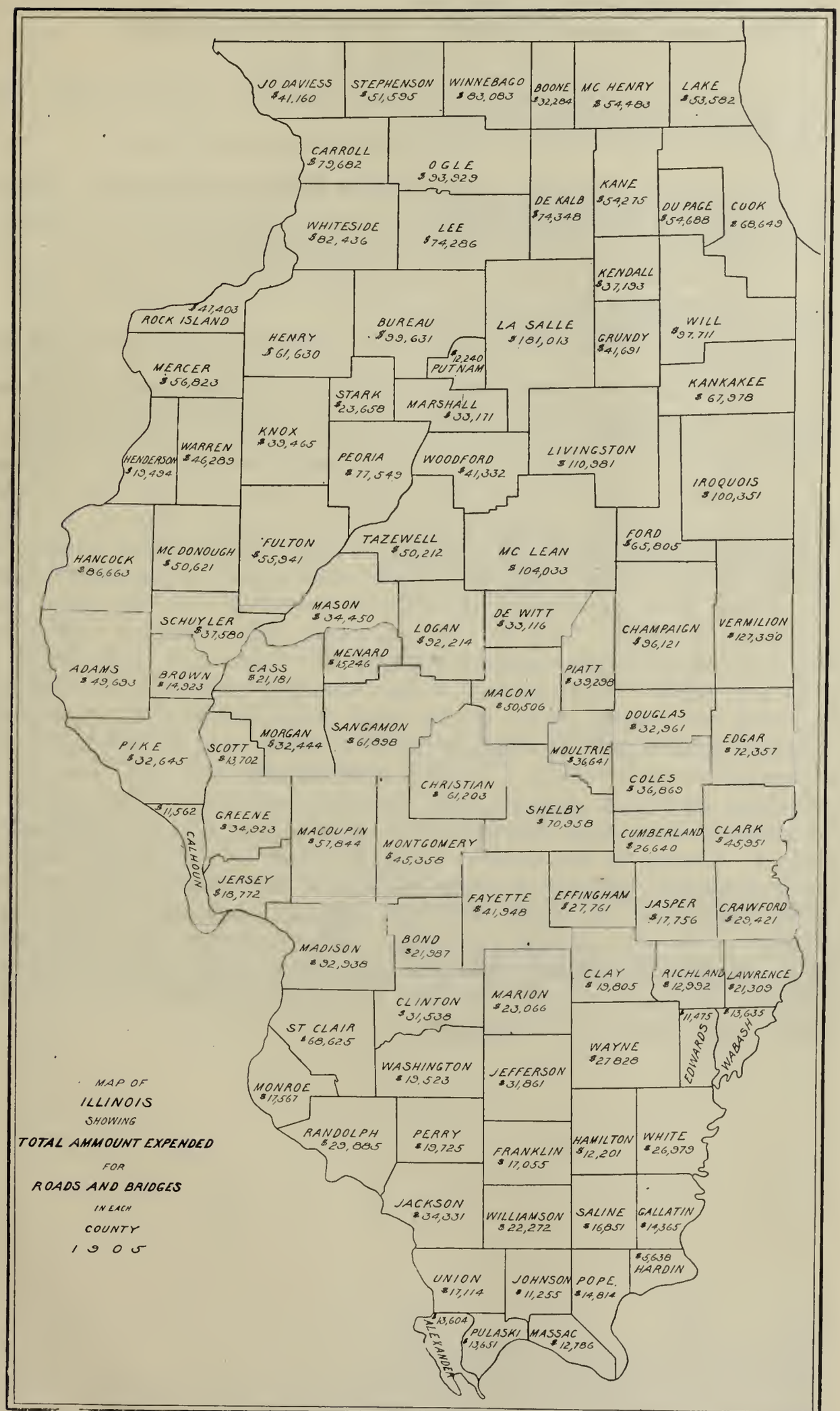

FIG. 1. Showing total amount expended for roads and bridges in each county in 1905.

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12. How much money was spent in your township in 1905?
For construction and repair of bridges, $.....
For construction of new stone or gravel roads, $.....
For repair and maintenance of all roads, including grading, tiling, culverts, mowing weeds, etc., $.....
For the purchase of road implements, etc., $.....
Total, $.....
If you have only the total amount, please estimate carefully the amount spent on each of the various items.
13. What is the cash value of all road taxes worked out in your township in 1905, $.....
14. What amount of money did you receive in 1905 from your county,
For road purposes, $.....
For bridge purposes, $.....
15. How many road overseers in your township, excluding all highway commissioners?
We, the undersigned, hereby certify that the statements made in answer to the above questions are, to the best of our knowledge, correct.
Attest: TOWN CLERK. (Signed), HIGHWAY COMMISSIONERS.

The majority of the townships responded readily to the requests for this information, and to the extent of their ability the various officials answered the questions submitted to them. But it was evident, from the nature of the answers in many cases, rather than from the lack of any reply, that in general the records of amounts spent and of the work accomplished in most townships are far from systematic or complete. Up to Oct. 1st there still remained 339 townships or road districts scattered about the State that had failed to make any reply. The opinion of the Attorney General was obtained regarding the responsibility of the local commissioners to answer the questions, which opinion, together with a letter, was forwarded to the delinquent commissioners. Replies were finally received from 1,444 townships and road districts, but 169 were missing. The results of the answers have been tabulated for each county and summarized in Table 1. Owing to the evident incompleteness of the replies returned by the township officials in many instances, the tabulated results cannot be considered as exact, although without question, they are sufficiently so for all practical purposes. Where returns have been lacking or manifestly in error, estimates have been made in light of the information already at hand, so that it is believed that the totals for each county cannot be far wrong.

Table 1.

Mileage and Cost of maintaining the Public Highways of Illinois for the year 1905. Based on returns made by township officials to the State Highway Commission.

	County.	Area in square miles	Total mileage of public roads.	Miles of road per square mile.	Miles of gravel and macadam.	Per cent of total mileage—gravel and macadam	*Equalized assessment of taxable property	Cash Expenditures.			Money value of labor tax	Total cost in money and labor for roads and bridges
								Highway bridges	Road construction and repairs	Cash expenditure for roads and bridges		
1	Adams	830	1,543	1.9	161	10.4	$ 12,610,059	$20,275	$27,867	$48,142	$ 1,551	$49,693
2	Alexander	220	427	1.9	20	4.7	2,674,262	500	11,823	12,323	1,281	13,604
3	Bond	380	674	1.8	1	0.0	2,312,136	7,962	13,419	21,381	606	21,987
4	Boone	288	510	1.8	227	44.6	4,427,273	8,954	18,030	26,984	5,300	32,284
5	Brown	306	462	1.5	.....	.....	1,885,361	2,734	9,650	12,384	2,539	14,923
6	Bureau	846	1,583	1.9	447	28.2	12,095,419	42,344	49,784	92,128	7,503	99,631
7	Calhoun	251	288	1.1	2	0.1	1,101,876	2,654	6,129	8,783	2,779	11,562
8	Carroll	450	807	1.8	42	5.2	4,727,297	24,813	51,329	76,142	3,540	79,682
9	Cass	460	523	1.1	.....	.....	4,039,437	3,411	17,091	20,502	679	21,181
10	Champaign	1,008	1,830	1.8	5	0.3	15,154,379	33,155	56,959	90,114	6,007	96,121
11	Christian	702	1,351	1.9	14	1.0	8,655,023	24,126	22,812	46,938	14,265	61,203
12	Clark	513	1,063	2.0	43	4.0	2,760,784	9,835	25,622	35,457	10,494	45,951
13	Clay	466	922	1.9	.....	.....	2,376,239	8,820	7,755	16,575	3,230	19,805
14	Clinton	487	704	1.4	.....	.....	3,067,488	13,575	14,103	27,678	3,860	31,538
15	Coles	520	897	1.7	23	2.6	6,792,659	12,879	20,690	33,569	3,300	36,869
16	Cook	†890	1,450	1.6	734	50.6	441,990,246	47,828	20,821	68,649	.....	68,649
17	Crawford	470	715	1.5	10	1.4	2,579,730	8,447	16,600	25,047	4,374	29,421
18	Cumberland	350	687	1.9	5	0.7	2,069,817	6,655	11,865	18,520	8,120	26,640
19	DeKalb	650	1,096	1.7	392	35.8	9,868,915	32,560	37,199	69,759	4,589	74,348
20	DeWitt	440	737	1.7	.....	.....	5,168,368	5,015	27,901	32,916	200	33,116
21	Douglas	410	709	1.7	.....	.....	5,681,442	12,065	11,231	29,296	3,665	32,961
22	DuPage	340	629	1.8	392	62.3	7,057,540	13,124	39,914	53,038	1,650	54,688
23	Edgar	640	1,187	1.8	212	17.7	7,936,685	13,820	53,565	67,385	4,972	72,357
24	Edwards	220	460	2.0	.....	.....	1,437,129	4,009	5,694	9,703	1,772	11,475
25	Effingham	486	930	1.9	2	0.2	2,945,585	14,466	8,610	23,076	4,685	27,761

Table 1—Concluded.

	County.	Area in square miles	Total mileage of public roads.	Miles of road per square mile.	Miles of gravel and macadam.	Per cent of total mileage—gravel and macadam	Equalized assessment of taxable property	Cash Expenditures. Highway bridges	Road construction and repairs	Cash expenditure for roads and bridges	Money value of labor tax	Total cost in money and labor for roads and bridges
26	Fayette	720	1,163	1.6	4	0.3	$ 3,802,229	$17,226	$ 19,610	$ 36,836	$ 5,112	$ 41,948
27	Ford	580	785	1.4	85	10.8	6,667,456	25,091	31,028	56,119	9,686	65,805
28	Franklin	430	740	1.7	2	0.3	1,949,990	6,611	8,072	14,683	2,372	17,055
29	Fulton	864	1,698	1.9	1	0.0	8,715,361	22,989	24,493	47,482	8,459	55,941
30	Gallatin	340	491	1.4	.....	.....	1,432,968	4,813	7,392	12,205	2,160	14,365
31	Greene	540	805	1.5	.....	.....	4,523,066	14,184	16,589	30,773	4,150	34,923
32	Grundy	440	748	1.7	71	9.5	6,057,205	20,129	20,962	41,091	600	41,691
33	Hamilton	440	744	1.7	.....	.....	1,626,494	2,911	6,628	9,539	2,662	12,201
34	Hancock	780	1,178	1.5	22	1.9	7,508,997	56,179	22,719	78,898	7,765	86,663
35	Hardin	180	245	1.3	.....	.....	420,432	482	3,803	4,285	1,353	5,638
36	Henderson	380	607	1.6	.....	.....	3,134,154	9,050	9,780	18,830	664	19,494
37	Henry	825	1,430	1.7	3	0.0	10,695,834	27,900	30,225	58,125	3,505	61,630
38	Iroquois	1,100	1,919	1.8	58	3.0	12,327,365	44,941	42,493	87,434	12,917	100,351
39	Jackson	580	871	1.5	4	0.5	3,241,767	13,182	17,016	30,198	4,133	34,331
40	Jasper	484	844	1.7	.....	.....	2,571,426	5,085	6,120	11,205	6,551	17,756
41	Jefferson	466	1,174	2.5	.....	.....	2,721,197	8,817	13,438	22,255	9,606	31,861
42	Jersey	360	598	1.7	2	0.3	2,529,993	9,668	7,699	17,367	1,405	18,772
43	JoDaviess	650	1,034	1.6	47	4.5	5,775,902	17,839	15,193	33,032	8,128	41,160
44	Johnson	340	605	1.8	.....	.....	1,331,365	5,100	3,675	8,775	2,480	11,255
45	Kane	540	971	1.8	724	74.3	16,382,411	17,270	30,705	47,975	6,300	54,275
46	Kankakee	680	1,127	1.7	138	12.3	8,222,872	28,015	33,086	61,101	6,877	67,978
47	Kendall	321	530	1.6	242	45.7	3,839,926	13,618	20,075	33,693	3,500	37,193
48	Knox	720	743	1.1	3	0.4	11,091,523	20,781	16,764	37,545	1,920	39,465
49	Lake	394	835	2.1	285	34.2	10,158,484	14,939	30,209	45,148	8,434	53,582
50	LaSalle	1,152	1,919	1.7	461	24.2	19,932,997	70,054	105,099	175,153	5,860	181,013
51	Lawrence	362	636	1.8	25	3.9	1,998,143	8,869	10,348	19,217	2,092	21,309
52	Lee	728	1,189	1.6	135	11.4	9,305,098	31,463	37,135	68,598	5,688	74,286
53	Livingston	1,026	1,734	1.7	68	3.9	15,886,457	40,864	48,278	89,142	21,839	110,981
54	Logan	620	1,014	1.6	5	0.5	9,529,332	46,518	43,196	80,714	2,500	92,214
55	Macon	580	1,025	1.8	61	6.0	10,047,785	16,648	32,748	49,396	1,110	50,506

56	Macoupin	864	1,369	1.6	.....	.....	7,844,711	23,549	25,751	49,300	8,544	57,844
57	Madison	740	1,509	2.0	26	1.7	14,058,992	42,901	43,693	86,594	6,344	92,938
58	Marion	576	1,145	2.0	2	0.2	3,618,458	7,932	7,371	15,303	7,763	23,066
59	Marshall	350	634	1.8	46	7.4	4,943,769	11,106	20,215	31,321	1,850	33,171
60	Mason	518	771	1.5	.....	.....	4,255,552	19,099	14,401	33,500	950	34,450
61	Massac	240	403	1.7	45	11.1	1,377,657	1,180	9,606	10,786	2,000	12,786
62	McDonough	576	1,196	2.0	.....	.....	7,377,369	22,650	24,413	47,063	3,558	50,621
63	McHenry	612	1,134	1.9	619	54.5	8,410,442	17,076	35,907	52,983	1,500	54,483
64	McLean	1,161	2,069	2.3	106	5.1	22,455,671	53,519	45,133	98,652	5,381	104,033
65	Menard	311	411	1.3	.....	.....	3,827,304	9,338	4,301	13,639	1,607	15,246
66	Mercer	550	904	1.6	.....	.....	6,034,349	31,812	20,691	52,503	4,320	56,823
67	Monroe	380	703	1.8	19	2.7	2,154,171	3,612	10,131	13,743	3,824	17,567
68	Montgomery	740	1,220	1.6	3	0.2	6,547,760	24,236	15,838	40,074	5,284	45,358
69	Morgan	563	832	1.5	.....	.....	8,025,367	13,470	18,419	31,889	555	32,444
70	Moultrie	340	551	1.6	.....	.....	3,835,581	20,734	5,357	26,091	10,550	36,641
71	Ogle	773	1,222	1.6	172	14.1	9,370,893	51,845	37,905	89,750	4,179	93,929
72	Peoria	630	983	1.6	222	22.5	19,096,016	45,205	28,069	73,274	4,275	77,549
73	Perry	432	668	1.5	.....	.....	2,364,559	5,035	10,745	15,780	3,945	19,725
74	Piatt	440	621	1.4	.....	.....	6,509,656	21,952	15,950	37,902	1,396	39,298
75	Pike	756	1,347	1.8	51	3.8	4,860,428	17,078	12,760	29,838	2,807	32,645
76	Pope	360	465	1.3	7	0.5	912,243	204	9,133	9,337	5,477	14,814
77	Pulaski	190	346	1.8	4	0.1	1,226,068	4,438	6,139	10,577	3,074	13,651
78	Putnam	170	287	1.7	34	1.2	1,587,656	4,800	6,740	11,540	700	12,240
79	Randolph	560	974	1.7	10	1.0	3,860,717	9,548	13,805	23,353	6,532	29,885
80	Richland	380	770	2.0	.....	.....	2,005,869	5,450	4,407	9,857	3,135	12,992
81	Rock Island	420	784	1.9	30	3.8	9,651,600	15,893	20,658	36,551	10,852	47,403
82	Saline	396	354	1.1	.....	.....	2,034,187	3,461	7,682	11,143	5,708	16,851
83	Sangamon	875	1,220	1.4	1	0.0	19,145,316	16,571	37,419	53,990	7,908	61,898
84	Schuyler	414	736	1.8	4	0.5	2,802,464	13,604	13,406	27,010	10,570	37,580
85	Scott	252	440	1.7	.....	.....	2,111,576	4,584	8,513	13,097	605	13,702
86	Shelby	760	1,575	2.0	1	0.0	6,750,311	29,400	26,808	56,208	14,750	70,958
87	Stark	290	443	1.5	2	0.5	3,395,340	11,365	11,208	22,573	1,085	23,658
88	St. Clair	680	1,139	1.7	26	2.3	17,849,057	31,987	34,905	66,892	1,733	68,625
89	Stephenson	573	959	1.7	93	9.7	8,832,603	23,147	15,724	38,871	12,724	51,595
90	Tazewell	650	998	1.5	50	5.0	9,001,625	26,253	23,138	49,391	821	50,212
91	Union	400	626	1.6	23	3.7	2,190,563	1,889	12,110	13,999	3,115	17,114
92	Vermilion	882	1,598	1.8	188	11.8	16,097,719	53,865	66,625	120,490	6,900	127,390
93	Wabash	220	401	1.9	.....	.....	1,752,475	6,585	4,819	11,404	2,231	13,635
94	Warren	540	1,045	1.9	6	0.6	7,311,318	22,564	22,100	44 664	1,625	46,289
95	Washington	557	772	1.4	.....	.....	2,512,470	6,338	10,980	17,318	2,205	19,523
96	Wayne	720	1,263	1.8	.....	.....	2,743,594	11,184	9,500	20,684	7,144	27,828
97	White	500	600	1.2	.....	.....	2,859,970	8,645	11,904	20,549	6,430	26,979
98	Whiteside	676	1,120	1.7	179	1.6	8,647,450	38,954	34,425	73,379	9,057	82,436
99	Will	850	1,534	1.8	343	22.4	15,483,154	42,992	46,327	89,319	8,392	97,711
100	Williamson	440	587	1.3	.....	.....	3,166,900	4,283	13,221	17,504	4,768	22,272
101	Winnebago	540	931	1.7	367	39.4	12,780,125	31,485	48,398	79,883	3,200	83,083
102	Woodford	556	896	1.6	7	0.1	7,155,004	20,644	12,287	32,931	8,401	41,332
	Totals	55,648	94,141	1.7	7,864	7.7	$1,095,681,557	$1,888,724	$2,246,078	$4,134,802	$490,563	$4,625,365

* The equalized valuation is one-fifth of the assessed valuation. †Area of Cook county includes Chicago, thus reducing the mileage per square mile.

REPORTS FROM RURAL LETTER CARRIERS.

It was early decided to secure through the Postoffice Department, the coöperation of the rural letter carriers to ascertain the condition of the various roads over which they travel. These men from the very nature of their work are probably better acquainted with road conditions in their respective neighborhoods than anyone else to be found. They travel the roads daily year in and year out, so that the condition of the road becomes to them a matter of daily moment.

A request was made to the Postoffice Department to furnish the State Highway Commission a list of all the letter carriers in the State, to whom the following list of questions might be sent. The department in reply notified all the postmasters in the State to furnish any information they could:

QUESTIONS ADDRESSED TO THE RURAL FREE DELIVERY CARRIERS.

Name.....; P. O.....; Number of route.....; County.....; Location of route, from..... via.....to.....; Length.....miles.

Is road earth, gravel or rock, miles of each.....

Condition of each kind of road in winter, spring, summer, fall.

Has condition of your route this past winter prevented general use of the roads? 1st, by loaded wagons; 2d, by unloaded wagons; do not include obstruction by snowdrifts.

Has it been impassable, except for snowdrifts, state about the number of days impassable.

Have you been unable, except for snowdrifts, to deliver the mail on your route, because of the condition of the road?

What is the usual time of year work is done on these roads?

What is the general nature of this work?

Has any section of this road been dragged with a log or plank drag, if so, for what distance?

When was it first dragged?

About how many times do you estimate it has been dragged up to the present time?

By whom is dragging done? Names.....; Addresses.....

What has been the effect of dragging, state kind of soil?

Are there any concrete culverts, state number?

Is wood used for culverts and bridges?

Are there any vitrified clay pipe, or iron pipe culverts, state how many?

Do the pipe culverts have protecting masonry end walls?

Give names of any road leagues, or associations in the neighborhood of your route. Name of Association.....; President.....; P. O. Address.....

The list of questions was sent to each of the 2,600 rural letter carriers in the State at that time. Replies were received from 1,340 and the results tabulated accordingly. The reports received cover 33,000 miles of road, or about one-third of the total mileage in the State.

There is no other way by which such accurate information could be obtained over so large a mileage at such a trifling cost to the State Commission. This was the first time that such a plan of coöperation with the Postoffice Department had been undertaken in any state, but it has since been used with success in a number of others, including Missouri, New York, Minnesota and Wisconsin.

A special effort was made to find how extensively road drags had been used this past season. Out of a total of 33,000 miles it will be noticed that over 3,600 miles are reported as dragged and that there were nearly 2,600 drags in use on the routes covered by the 1,340 carriers submitting reports. As they represent but half of the carriers in the State, and as it is fair to presume that the conditions prevailing on the other routes are about the same as those reported, one could expect to double the figures as given in the table. But from the nature of the answers in some cases it is probable that the use of harrow was interpreted as a drag, whereas the questions asked the carriers were intended to elicit information concerning the earth road drag or split log drag. It is probably not far wrong to state that the past season has seen 4,000 drags put in use, each one of which has cared for a little over a mile of road. The number of times the drag has been used varied from thirty to forty times to once or twice, the average being about three times. The effect of the drag was reported to be good in every instance.

In summarizing the times of the year when it was reported that actual work on the roads was done, it was found that the great majority of the work, at least 68 per cent, particularly on the earth roads, is done during the dry season, which, as stated elsewhere, is exactly the wrong time to do this sort of work.

Table 2 shows in detail the tabulation of the information received from the letter carriers.

TABLE 2.

Summary of Reports Made by Rural Letter Carriers.

COUNTY.	Total miles reported	Miles of earth road	Miles of gravel or macadam roads	Miles dragged	Number of drags	PROPORTION OF WORK REPORTED DONE IN—			
						Winter	Spring.	Summer.	Fall.
Adams	499	440	59	70	52	.....	¼	¼	½
Alexander	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bond	246	246	.....	10	21	.....	¼	½	¼
Boone	98	45	53	16	7	.....	.....	⅔	⅓
Brown	247	247	.....	90	33	.....	¼	.....	¾
Bureau	356	235	112	7	6	.....	1/25	1/5	3/5
Calhoun	72	67	5	1	1	.....	1/25	.....	3/5
Carroll	320	300	20	29	19	.....	1/6	1/6	⅔
Cass	608	608	.....	87	25	.....	.....	⅓	⅔
Champaign	681	669	12	84	40	.....	½	¼	¼
Christian	489	485	4	139	83	.....	¼	¼	½
Clark	462	419	31	15	14	.....	1/5	3/10	½
Clay	373	373	.....	14	24	.....	¼	¼	½
Clinton	98	98	.....	6	6	.....	½	.....	½
Coles	298	264	34	15	16	.....	⅓	1/6	½
Cook	338	147	191	4	.....	.....	⅓	⅓	⅓
Crawford	263	244	19	15	21	.....	1/5	3/10	½
Cumberland	292	290	2	13	18	.....	1/6	⅓	½
DeKalb	249	155	94	12	8	.....	½	1/6	⅓
DeWitt	357	357	.....	40	45	.....	⅓	1/6	½
Douglas	328	328	.....	14	18	.....	½	¼	¼
DuPage	169	59	110	11	3	.....	⅓	¼	½
Edgar	370	261	109	23	16	.....	1/5	3/10	½
Edwards	166	166	.....	33	16	.....	½	.....	½
Effingham	334	331	3	28	26	.....	1/6	⅓	½
Fayette	387	386	1	23	22	.....	⅓	1/6	½
Ford	288	248	40	19	17	.....	⅓	⅓	⅓
Franklin	289	289	.....	8	18	.....	¼	¼	½
Fulton	320	320	.....	74	70	.....	.....	.....	1
Gallatin	190	190	.....	8	7	.....	½	3/10	1/5
Greene	270	268	2	50	31	.....	⅓	½	1/6
Grundy	200	177	23	10	7	.....	½	1/6	⅓
Hamilton	206	206	.....	10	9	.....	1/6	⅓	½
Hancock	593	576	17	75	56	.....	3/10	1/5	½
Hardin	.....	.....	.....	.....	.....	.....	.....	.....	.....
Henderson	.....	.....	.....	.....	.....	.....	.....	.....	.....
Henry	428	426	2	44	16	.....	1/5	3/10	½
Iroquois	385	375	10	26	26	.....	⅓	⅓	⅓
Jackson	479	474	5	69	64	.....	½	.....	½
Jasper	404	404	.....	12	12	.....	¼	¼	½
Jefferson	470	470	.....	34	41	.....	¼	¼	½
Jersey	142	141	1	27	14	.....	⅓	⅓	⅓
JoDaviess	357	320	37	5	4	.....	⅓	1/6	½
Johnson	203	187	16	.....	.....	.....	½	1/5	3/10
Kane	306	108	195	1	2	.....	½	.....	½
Kankakee	337	275	62	9	8	.....	⅓	1/6	½
Kendall	172	111	60	9	2	.....	.....	¾	¼
Knox	417	413	4	20	17	.....	¼	¼	½
Lake	175	112	63	1	1	.....	½	⅓	1/5
LaSalle	753	558	195	56	32	.....	⅓	⅓	⅓
Lawrence	310	274	36	30	33	.....	1/6	⅓	½
Lee	248	227	21	20	17	.....	½	1/6	⅓
Livingston	790	755	35	155	105	.....	½	1/6	⅓
Logan	450	450	.....	66	74	.....	½	1/6	⅓
McDonough	475	475	.....	93	91	.....	¼	¼	½
McHenry	232	59	173	42	8	.....	⅓	⅓	⅓
McLean	959	918	41	211	152	.....	½	¼	¼
Macon	349	333	16	85	61	.....	¼	¼	½
Macoupin	479	479	.....	117	81	.....	1/5	3/10	½
Madison	448	437	11	39	17	.....	½	1/6	⅓
Marion	497	494	3	18	19	.....	¼	¼	½
Marshall	98	92	6	7	6	.....	.....	.....	.....
Mason	303	296	7	26	26	.....	.....	.....	1
Massac	83	60	23	.....	.....	.....	½	.....	½
Menard	396	396	.....	186	40	.....	1/6	⅓	½
Mercer	339	338	1	24	33	.....	¼	¼	½
Monroe	91	89	2	42	9	.....	1	.....	.....

Table 2—Concluded.

County.	Total miles reported	Miles of earth road	Miles of gravel or macadam roads	Miles dragged	Number of drags	Proportion of Work Reported Done in—			
						Winter	Spring.	Summer.	Fall.
Montgomery	553	553	.....	149	63	.....	1/5	3/10	1/2
Morgan	301	301	.....	85	53	.....	1/3	1/6	1/2
Moultrie	260	260	.....	27	22	.....	1/3	1/6	1/2
Ogle	446	372	74	14	17	.....	1/3	1/6	1/2
Peoria	505	402	103	43	40	.....	.....	1/2	1/2
Perry	243	243	.....	23	17	.....	.....	.....	1
Piatt	280	280	.....	38	22	.....	1/2	1/6	1/3
Pike	403	376	27	28	39	.....	1/6	1/3	1/2
Pope	26	25	1	.....	.....	.....	.....	.....	.....
Pulaski	28	28	12	.....	.....	.....	.....	1/2	1/2
Putnam	94	82	12	13	4	.....	1/2	.....	1/2
Randolph	581	575	6	34	33	.....	1/2	1/6	1/3
Richland	340	340	.....	50	56	.....	1/2	1/6	1/2
Rock Island	230	225	5	10	4	.....	1/6	1/3	1/2
Saline	400	379	21	37	27	.....	1/2	1/6	1/3
St. Clair	65	65	.....	1	2	.....	1/2	3/10	1/5
Sangamon	988	988	.....	168	68	.....	1/5	3/10	1/2
Schuyler	249	249	.....	65	31	.....	1/4	1/4	1/2
Scott	49	49	.....	6	3	.....	.....	1/2	1/2
Shelby	565	563	2	52	35	.....	1/4	1/4	1/2
Stark	132	132	.....	13	6	.....	.....	.....	1
Stephenson	220	216	4	29	28	.....	1/2	1/6	1/3
Tazewell	292	287	5	60	53	.....	1/2	1/4	1/4
Union	268	242	26	9	15	.....	1/2	.....	1/2
Vermilion	583	503	80	23	27	.....	1/3	1/6	1/2
Wabash	170	165	5	18	17	.....	1/2	3/10	1/5
Warren	289	278	11	4	3	.....	.....	.....	1
Washington	175	175	.....	8	6	.....	1/3	1/6	1/2
Wayne	477	477	.....	18	19	.....	1/3	1/3	1/3
White	514	494	20	48	38	.....	1/2	.....	1/2
Whiteside	478	334	144	3	2	.....	1/6	1/3	1/2
Will	464	323	141	8	18	.....	1/3	1/2	1/6
Williamson	121	121	.....	4	4	.....	1/2	1/2	.....
Winnebago	343	217	126	1	2	.....	1/6	1/3	1/2
Woodford	405	390	15	54	45	.....	1/3	1/4	.....
Total	33,568	31,533	4,746	3,650	2,585	.....	32%	23%	45%

ROAD MEETINGS ATTENDED IN 1906.

The actual work of the commission had scarcely begun before requests were received by the State Engineer to attend meetings and give talks on road construction. The number of requests has shown a very general desire for information about road improvement.

Many of the meetings were held specially to discuss local road matters. An important series of meetings was arranged and held under the management of the Chicago & Alton Railroad, who engaged a number of speakers and placed at their disposal a special train. Stops at various points along the line of road were made and lectures given on the improvement of earth roads, particularly on the use of the earth road drag, which was explained at length by Mr. D. Ward King, of Missouri, who is so well known for his work in this particular. An invitation was extended by the railroad to the State Highway Commission to have a representative present, and also to members of the State University. Meetings were held in the morning and afternoon at each place the train stopped, and large and appreciative audiences were in attendance.

Perhaps the most important series of meetings to which the commission was invited to send a speaker were those held by the farmers' institutes, from which sixty-seven requests were received. Every effort was made to fulfill these engagements, but owing to the limited time in which to plan for them and to the fact that many of the institutes were held on the same date, it was impossible to attend all of them. About thirty engagements, however, were made. Table 3 gives a list of all the meetings attended, together with the date and the name of the association under whose auspices the meeting was held.

Table 3.

Meetings Attended.

Date.	County.	Town.	Association.
1906			
Jan. 18	Winnebago ...	Rockford.....	21st annual meeting, Ill. Soc. Engineers and Surveyors..
Feb. 12	Livingston....	Dwight	Chicago & Alton road train .....
Feb. 13	..do.....	Pontiac	..do.....
Feb. 14	McLean	Bloomington..	..do.....
Feb. 15	Logan.....	Lincoln	..do.....
Feb. 16	Macoupin	Carlinville	..do.....
Feb. 17	Greene	Whitehall.....	..do.....
Feb. 19	Woodford	Washburn	..do.....
Feb. 20	Logan.....	New Holland..	..do.....
Feb. 21	Tazewell	Delavan.....	..do.....
Mar. 16	Henry.....	Galva	Galva Institute Road Improvement Association... ....
Mar. 22	Rock Island...	Milan	Special road meeting.....
Mar. 24	Bond	Greenville	..do.....
April 7	Macon.....	Decatur	Farmers Institute .....
April 14	Wabash.....	Mt. Carmel....	Special road meeting.....
April 21	Fulton	Canton	Highway Commissioners' Association.....
July 13	Macoupin	Carlinville	Rural Letter Carriers' Association of Illinois .....
Aug. 17	.....	Ames, Iowa ...	Road School Iowa Highway Commission.....
Sept. 5	Chillicothe, Mo	.....	Interstate good roads convention.....
Sept. 19	LaSalle	Mendota	Harvest Home Association.....
Oct. 10	Tazewell	Washington ..	Farmers Institute .....
Oct. 11	Peoria	Trivoli	..do.....
Oct. 17	Sangamon	Williamsville .	..do.....
Oct. 19	Christian.....	Mt. Auburn ...	..do.....
Oct. 24	Bond	Reno	..do.....
Oct. 25	Madison.....	Edwardsville..	..do.....
Oct. 26	Monroe.....	Waterloo	..do.....
Nov. 1	Macoupin	Carlinville	..do.....
Nov. 3	Montgomery ..	Raymond	..do.....
Nov. 15	St. Clair	O'Fallon	..do.....
Nov. 16	Washington ..	Nashville	..do.....
Nov. 24	Jackson.....	Ava	..do.....
Dec. 7	Tazewell	Delavan.....	..do.....
Dec. 11	Jersey.....	Jerseyville....	..do.....
..do.....	Macon.....	Decatur	..do.....
..do.....	Ogle.....	Oregon	..do.....
Dec. 12	Pike	Pittsfield	..do.....
..do.....	Lee.....	Franklin Gr've	..do.....
Dec. 13	Whiteside	Fulton	..do.....
..do.....	Henry.....	Geneseo.....	..do.....
Dec. 14	Menard	Petersburg ...	..do.....
Dec. 15	DeWitt	Farmer City..	..do.....
Dec. 18	Stark	Castleton	..do.....
Dec. 20	Clark.....	Marshall	..do.....
..do.....	Carroll	Mt. Carroll....	..do.....
..do.....	Stephenson ...	Freeport	..do.....
Dec. 21	Bureau.....	Malden.....	..do.....
..do.....	JoDaviess.....	Stockton.....	..do.....
Dec. 22	Putnam	Magnolia.....	..do.....

The following engagements have been made for January, 1907:

Date.	County.	Town.	Association.
Jan. 10	LaSalle	LaSalle	Farmers Institute.....
..do.....	Piatt.....	Bement	..do.....
Jan. 11	Douglas.....	Arcola	..do.....
Jan. 12	Coles.....	Charleston....	..do.....
Jan. 15	DeKalb	Waterman....	..do.....
Jan. 16	Winnebago ...	Rockford.....	..do.....
Jan. 17	Kane.....	Geneva.....	..do.....
Jan. 18	Kankakee.....	.....	..do.....
..do.....	Iroquois.....	Gilman.....	..do.....
Jan. 11	Vermilion.....	Hoopeston	..do.....
Jan. 23	Henry.....	Galva	..do.....

ROAD TRAFFIC CENSUS.

So far as is known, there has been in this country no systematic effort made to ascertain the actual number of vehicles which traverse what is ordinarily known as a well traveled country road. Roads are usually described as well traveled or sparsely traveled as compared with one another in a particular locality, but the exact amount of use to which the roads are put has never been ascertained. It was, therefore, determined to make an actual count of the vehicles on a number of roads in different parts of the State, the object being to ascertain if possible what is the difference in the traffic over roads leading to large towns and those leading into smaller towns; the effect which the condition of the roads has upon travel; the effect due to the industries in a particular neighborhood; and from the results to deduce further conclusions which might at first be considered as having no special bearing. On the other hand, no attempt has been made, nor was it intended, to sum the total traffic on all the roads, as this would be a practical impossibility and for the present purposes not at all necessary. On a number of roads two stations, one near the destination of a road, that is, near the city or town to which the traffic comes, and another station three or four miles out, have been established. In between these stations are usually found two or three cross roads which must supply the difference in the amount of traffic noted at the two stations.

This work was begun gradually with a few observers in the vicinity of Springfield and one or two in other sections of the State. These stations were established in February, and from time to time, as other duties made necessary visits to other sections of the State, additional traffic stations were established until at present there is a total of thirty-seven stations on which traffic record is kept. The general location of these stations is shown on the map in Figure 2.

FIG. 2. Showing location of traffic census stations.

Form No. 18

STATE OF ILLINOIS HIGHWAY COMMISSION.
TRAFFIC RECORD.

Observer. Date Road

Condition of Road: Leading Into:

Address

HOURS AND WEATHER.	IN		OUT	
	Loaded	Unloaded	Loaded	Unloaded
6 A. M.				
7 A. M.				
8 A. M.				
9 A. M.				
10 A. M.				
11 A. M.				
12 M.				
1 P. M.				
2 P. M.				
3 P. M.				
4 P. M.				
5 P. M.				
6 P. M.				

REMARKS MAY BE MADE ON OPPOSITE SIDE OF THIS SHEET.

Fig. 3.

The method of counting and classifying traffic is, first, of vehicles going in or toward the city or town in which the station is established, and second, of vehicles going out or away from the town; distinction is also made between loaded and unloaded vehicles. The number of horses or animals attached to each vehicle is recorded and the record for each hour kept separate. Figure 3 is a reduced sketch of the actual blank that is used. On the back of each blank instructions for taking the traffic record are printed, as follows:

INSTRUCTIONS FOR TAKING TRAFFIC CENSUS.

Read these instructions carefully; if any point is not clearly understood write for further information to the State Highway Commission, Springfield, Illinois.

1. The observer should sign his or her name at the top of the record sheet in the proper space as indicated.
2. Fill in the date on which the record is taken.
3. In the space under "Condition of Road," state whether the road is dry and smooth, dry and rutted, frozen and smooth, frozen and rough, wet, with six inches of mud (or whatever may be about the depth of the mud). Do not state the condition of the road until the day is ended and then state as above directed the general condition for the entire day, using the words which best describe the actual conditions.
4. In the column headed "Hours and Weather," state each hour the condition of the weather as, "cloudy," "rainy," "fair," etc.
5. All vehicles going "IN" are those going towards town. All vehicles going "OUT" are those going away from town.
6. All passenger vehicles, as carriages and buggies, are to be classed as "unloaded."
7. All wagons carrying any load will be classed as "loaded;" otherwise as "unloaded."
8. The method of recording the traffic is as follows: If a two-horse vehicle passes, put down a small figure 2 opposite the proper hour and in the correct column. If going in (or towards town), the figure should be placed on the left side of the sheet in the column headed "Loaded or "Unloaded," as the case may be. A carriage of any kind should always be recorded as "unloaded," whether all the seats are occupied or not. Make an "A" for each automobile.
9. Aim to keep your record as clear and neat as possible. Use a medium hard pencil. Keep the pencil point sharp and do not moisten it.
10. Make your figures small and close together.
11. Each time that a record of traffic is to be taken you will be notified two days in advance of the date on which the record is to be taken.
12. As soon as the record for the day is completed, place it in the stamped and addressed envelope and mail it not later than the following day.

Each traffic station was established at some house on the road near enough to the city or town in question to include all the traffic going and coming to the country, but far enough out to exclude merely street traffic. The blanks were purposely made as simple as possible, with the idea that they could be kept by any bright boy or girl. The count was made at all stations on the same day, and were made about four times a month. The days were so selected that if the first count came on Monday, the next count would come some other day of the week; taking, for instance, first Monday of one week, Tuesday of the next, Wednesday of the next, and so on. In this way it would be possible to show what variation, if any, the day of the week made. As will be noticed, the blank provides for a record of the condition of the road and weather. In winter the traffic was recorded during

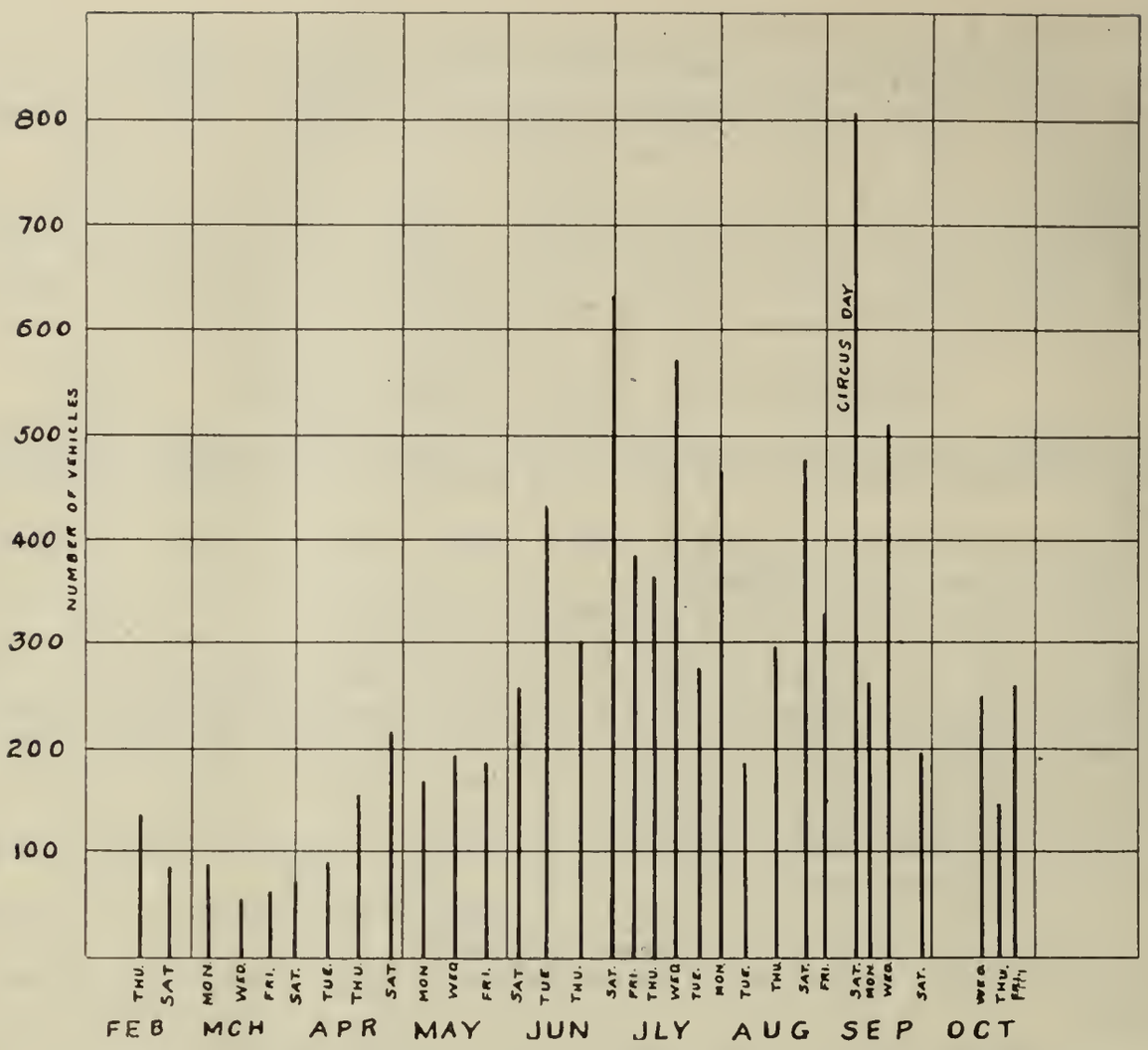

800
700
600
500
400
300
200
100
NUMBER OF VEHICLES
CIRCUS DAY
THU. SAT MON WED. FRI. SAT. TUE. THU SAT MON WED FRI. SAT TUE THU. SAT. FRI. THU. WED TUE. MON TUE. THU. SAT. FRI. SAT. MON WED. SAT. WED THU. FRI.
FEB MCH APR MAY JUN JLY AUG SEP OCT

FIG. 4. Traffic record on Clear Lake road, near Springfield.

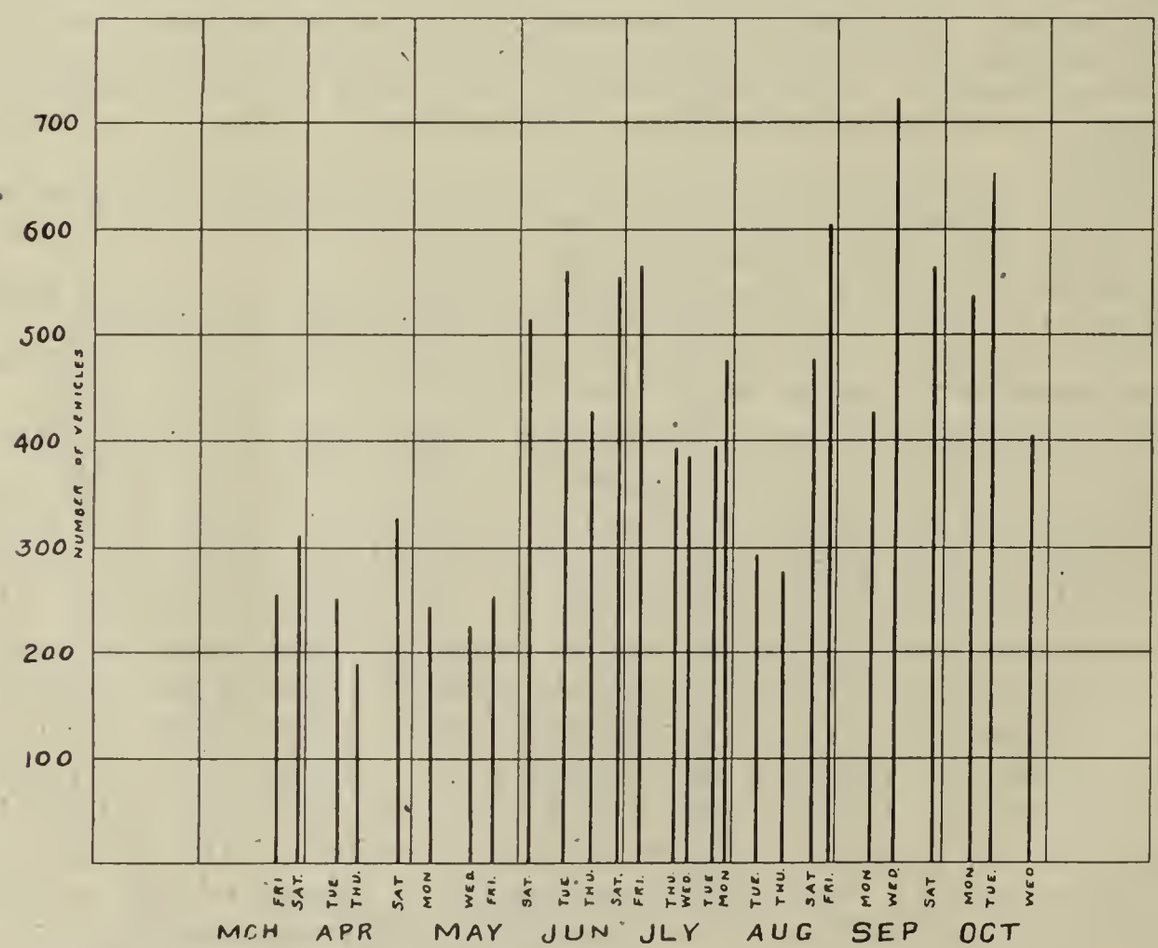

700
600
500
400
300
200
100
NUMBER OF VEHICLES
FRI SAT. TUE THU. SAT MON WED FRI. SAT TUE. THU. SAT. FRI. THU. WED. TUE MON TUE. THU. SAT FRI. MON WED. SAT MON TUE. WED
MCH APR MAY JUN JLY AUG SEP OCT

FIG. 5. Traffic record on Trask Bridge road, near Rockford.

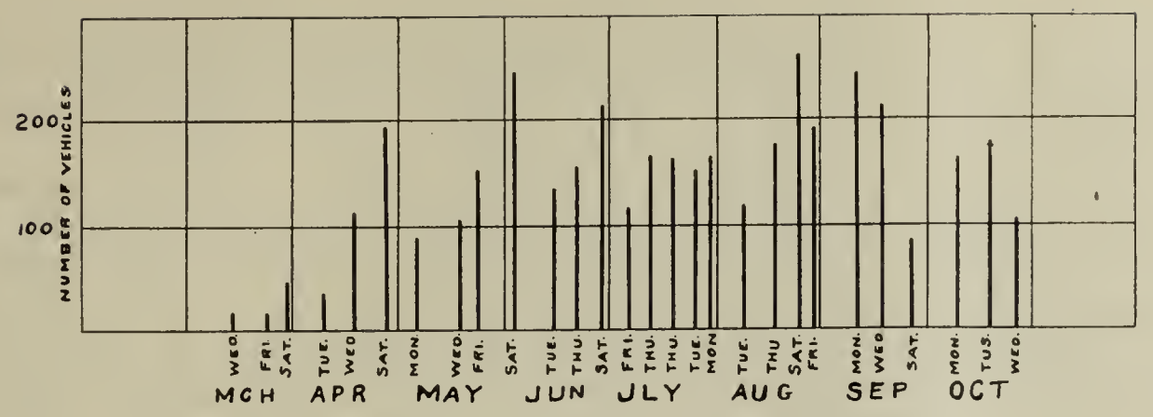

NUMBER OF VEHICLES
200
100
WED. FRI. SAT. TUE. WED SAT. MON WED. FRI. SAT. TUE. THU. SAT. FRI. THU. THU. TUE. MON TUE. THU SAT. FRI. MON. WED SAT. MON. TUS. WED.
MCH APR MAY JUN JLY AUG SEP OCT

FIG. 6. Traffic record on road near Centralia.

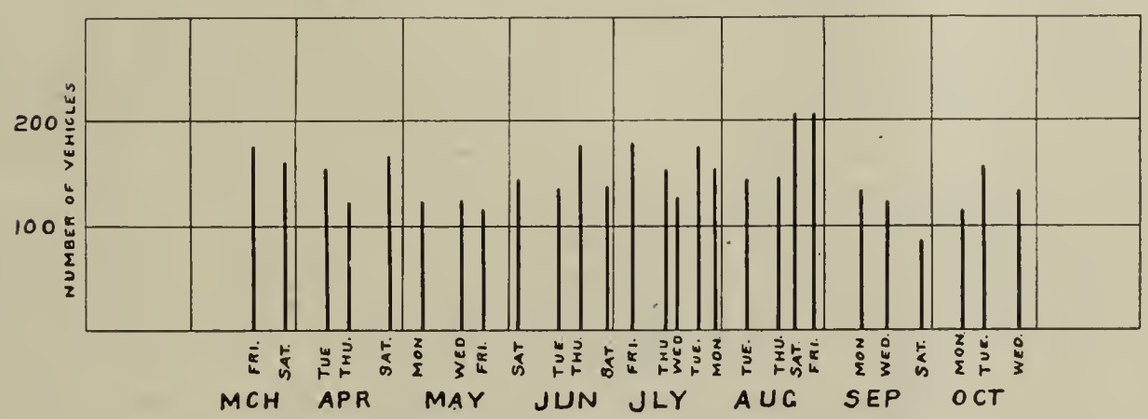

NUMBER OF VEHICLES
200
100
FRI. SAT. TUE THU. SAT. MON WED FRI. SAT TUE THU SAT FRI. THU WED TUE. MON TUE. THU. SAT. FRI. MON WED. SAT. MON TUE. WED.
MCH APR MAY JUN JLY AUG SEP OCT

FIG. 7. Traffic record on road near Peoria.

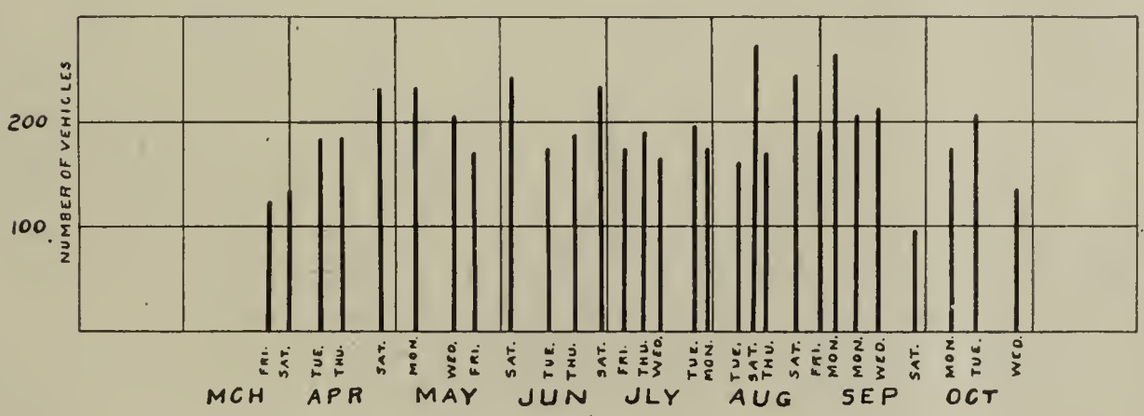

NUMBER OF VEHICLES
200
100
FRI. SAT. TUE. THU. SAT. MON. WED. FRI. SAT. TUE. THU. SAT. FRI. THU. WED. TUE. MON. TUE. SAT. THU. SAT. FRI. MON. MON. WED. SAT. MON TUE. WED.
MCH APR MAY JUN JLY AUG SEP OCT

FIG. 8. Traffic record on road near Elgin.

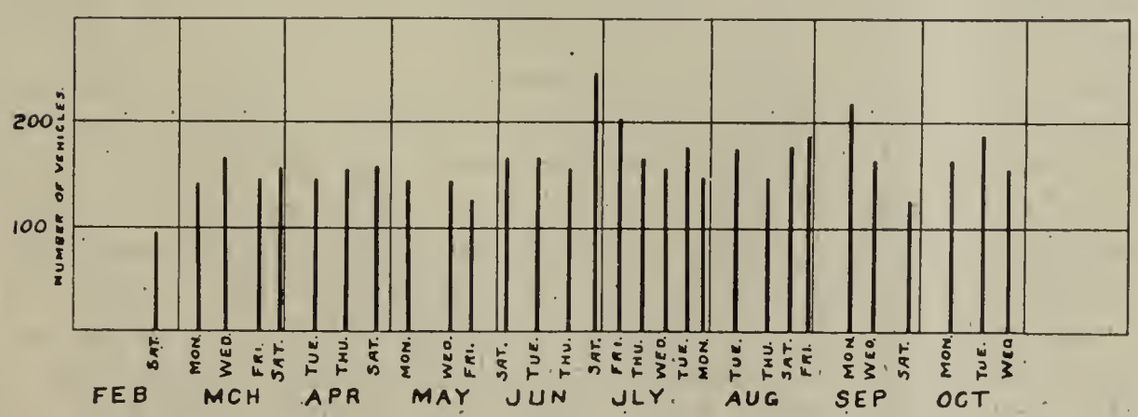

NUMBER OF VEHICLES
200
100
SAT. MON. WED. FRI. SAT. TUE. THU. SAT. MON. WED. FRI. SAT. TUE. THU. SAT. FRI. THU. WED. TUE. MON. TUE. THU. SAT. FRI. MON WED. SAT. MON TUE. WED
FEB MCH APR MAY JUN JLY AUG SEP OCT

FIG. 9. Traffic record on road near Elburn.

the daylight hours; at other seasons of the year from 6:00 a. m. to 7:00 p. m. The observers were paid $1.00 for each day the count was kept. This general method of taking traffic census has proved in every instance satisfactory and secures accurate results.

At least a year's observation would be necessary for any satisfactory conclusions, so that the results already obtained cannot be considered complete. Only a few of the stations show winter traffic, as the majority were not established until the spring or early summer. It is proposed, however, to continue the observation at each station for at least a full year, as the importance of the data already collected fully warrants a continuation of this work. In Table 4 is a complete list of the traffic stations, the names of the observers, and the date each station was established. It will be noticed that five stations were established in the vicinity of Springfield—two on the main road south and two on the main road east (along each of these roads interurban lines run), and the fifth station established some time afterwards on a road north of the city. Double stations were also established on a road leading into Peoria and on a road near Rockford.

The most striking feature found in these reports is best brought out graphically as shown in Figures 4, 5, 6, 7, 8 and 9, which indicate very clearly the variation in the traffic on the roads into Springfield, Rockford, Centralia, Peoria, Elgin and Elburn. The height of the heavy lines represents the relative amount of traffic in each instance. It will be noticed that during March and the first part of April, when the roads are extremely bad, the traffic into Springfield and Centralia, which is over earth roads, is very light, whereas the traffic into these same places during good weather is many times greater. The traffic into Rockford shows an increase in good weather, but the amount in bad weather is in very much greater proportion than on the earth roads. This traffic comes in over a macadam road. The traffic into Peoria, Elgin and Elburn, it will be noted, is remarkably uniform throughout the year. The roads in the vicinity of all these stations are gravel. In the vicinity of Elgin and Elburn dairy farming is carried on extensively, which necessitates daily marketing of products. Table 4 shows the total number of vehicles passing the different observation stations on the dates indicated, and from the figures in this table the diagrams were constructed. The greatest influence on the traffic is the weather and the resulting condition of the roads.

Another striking fact is that the size of the town to which the traffic comes is by no means a measure of the amount of traffic over the road. On those roads where there are two stations it will be seen that the amount of traffic at the farther station, which is but two or three miles beyond the station nearer town, has very much less traffic, that is, the amount of traffic recorded on these roads extends for a comparatively short distance, so that the travel on the road two or three miles out is but one-fourth the amount on the portion of the road nearer town. It is, therefore, evident that if the amount of money to be spent on a particular road is to be in proportion to its use, the first two or three miles near town should have four or five times as much spent on them.

TABLE 4.

Synopsis of Traffic Census Showing Total Number of Vehicles Passing on dates given, 1906.

Location of Station.	Population, 1900.	Character of Road.	Name of Observer.	February		March.				April.			May.			June.				July.					August.						September.								October.										November.			
				Thu.	Sat.	Mon.	Wed.	Fri.	Sat.	Tue.	Thu.	Sat.	Mon.	Wed.	Fri.	Sat.	Tue.	Thu.	Sat.	Fri.	Thu.	Wed.	Tue.	Mon.	Tue.	Sat.	Thu.	Thu.	Sat.	Thu.	Fri.	Mon.	Thu.	Sat.	Mon.	Wed.	Wed.	Fri.	Fri.	Thu.	Sat.	Wed.	Thu.	Fri.	Mon.	Thu.	Fri	Tue.	Fri.	Sun.	Wed	Thu.	Thu.	Fri.	Sat.	Mon.
				15	24	5	14	23	31	10	19	28	7	16	25	2	12	21	30	6	12	18	24	30	7	11	16	23	25	30	31	3	6	8	10	12	19	14	21	27	29	3	4	5	8	11	12	16	19	21	24	25	1	9	17	26
4 miles from Springfield on S. 6th St. road	34,159	Earth	Celia M. Neuman	21	19	7	7	9	7	19	22	88	63	51	54	118	54	32	70	84	72	69	69	76	33	.....	99	.....	83	.....	63	.....	.....	176	62	.....	65	.....	.....	.....	27	94	93	57	69	.....	.....	97	.....	.....	36	.....	91	101	63	51
1 mile from Springfield on S. 6th St. road	34,159	do	Olga Aarup	80	47	52	47	60	28	48	61	136	124	75	84	195	161	96	213	170	107	128	149	173	.....	.....	.....	.....	.....	.....	.....	.....	.....	242	138	.....	175	.....	.....	.....	72	144	93	133	123	.....	.....	162	.....	330	57	.....	134	109	127	97
4 miles from Springfield on Clear Lake road	34,159	do	Mrs. G. Fahrenhocher	9	12	9	11	7	8	19	24	78	37	84	34	64	43	57	76	75	86	105	62	70	41	.....	68	.....	65	.....	65	.....	.....	126	74	.....	83	.....	.....	.....	43	97	67	77	86	.....	.....	142	.....	.....	101	.....	101	107	80	93
¼ mile from Springfield on Clear Lake road	34,159	do	Mrs. John Colesar	136	84	85	51	60	66	89	155	215	161	194	189	256	431	302	634	389	364	573	275	464	184	.....	292	.....	479	.....	330	.....	.....	809	261	.....	519	.....	.....	.....	193	258	142	267	282	.....	.....	315	.....	.....	274	.....	251	286	286	251
Elhurn, Lilly Lake road	606	Gravel	Sadie Ballard	.....	.....	138	153	131	154	147	155	156	143	146	127	166	167	158	244	202	165	157	174	142	175	.....	149	.....	179	.....	184	.....	.....	.....	216	.....	163	.....	.....	.....	122	.....	.....	.....	165	.....	.....	186	.....	.....	152	.....	174	203	166	124
Centralia, east road	6,721	Earth	Dwight Miller	.....	.....	.....	17	12	47	32	119	193	90	102	155	249	133	154	213	125	169	160	150	167	113	.....	177	.....	263	.....	190	.....	.....	.....	247	.....	212	.....	.....	.....	87	.....	.....	.....	163	.....	.....	180	.....	.....	105	.....	134	118	77	75
Mt. Vernon, Fairfield road	5,216	do	Walter Warren	.....	.....	.....	51	30	117	182	148	292	158	151	213	257	173	149	291	170	143	153	215	182	115	.....	156	.....	285	.....	279	.....	.....	.....	260	.....	199	.....	.....	.....	78	.....	.....	.....	124	.....	.....	324	.....	.....	206	.....	241	239	104	135
Peoria, Knoxville road	56,100	Gravel	Mrs. C. W. McIntosh	.....	.....	.....	.....	174	159	155	127	166	121	124	111	141	134	174	132	180	155	128	174	151	146	.....	149	.....	207	.....	209	.....	.....	.....	139	.....	123	.....	.....	.....	83	.....	.....	.....	111	.....	.....	158	.....	.....	131	.....	172	153	133	115
4 miles from Peoria, Knoxville road	56,100	do	Grace Rork	.....	.....	.....	.....	111	63	79	69	105	42	73	93	116	114	104	107	126	83	68	88	68	77	.....	87	.....	113	.....	140	.....	.....	.....	68	.....	115	.....	.....	.....	29	.....	.....	.....	62	.....	123	86	.....	.....	67	.....	126	67	79	39
Rockford, Trask Bridge road	31,051	Macadam	Mrs. Wm. H. Lange	.....	.....	.....	.....	255	335	252	119	329	249	221	254	514	563	419	558	567	391	382	397	474	296	.....	279	.....	479	.....	602	.....	.....	.....	422	.....	722	.....	.....	.....	561	.....	.....	.....	535	.....	.....	658	.....	.....	403	.....	647	610	686	590
½ mile from Rockford, Trask Bridge road	31,051	do	Mrs. T. E. Detloff	.....	.....	.....	.....	130	186	140	76	170	83	59	101	201	116	132	291	148	123	108	97	138	89	.....	108	.....	186	.....	121	.....	.....	.....	100	.....	130	.....	.....	.....	183	.....	.....	.....	103	.....	.....	139	.....	.....	122	.....	153	118	150	112
Elgin, Ubina road	22,433	Gravel	J. H. Kelly	.....	.....	.....	.....	134	133	176	188	215	233	208	170	246	173	190	232	173	190	175	198	179	161	277	170	.....	247	.....	198	268	.....	.....	209	.....	214	.....	.....	.....	91	.....	.....	.....	175	.....	.....	209	.....	.....	138	.....	212	203	185	114
Jerseyville, Feldon road	3,517	Earth	Mattie Kirkpatrick	.....	.....	.....	.....	.....	28	48	105	151	90	115	66	232	129	112	157	112	129	184	218	252	53	.....	127	.....	216	.....	156	.....	.....	.....	197	.....	133	.....	.....	.....	53	.....	.....	.....	152	.....	.....	101	.....	.....	125	274	227	222	196	130
Greenville, Wisetown road	2,301	do	Mrs. Rose Hurst	.....	.....	.....	.....	.....	.....	69	92	208	166	205	230	307	285	328	361	315	1283	339	314	355	280	.....	335	.....	699	.....	565	.....	.....	.....	551	608	131	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	173	169	260	200
Sullivan, East road	2,399	do	Mrs. Sam T. Miller	.....	.....	.....	.....	.....	.....	.....	42	105	60	81	93	147	74	108	115	104	119	111	144	133	77	.....	84	226	179	.....	148	.....	.....	.....	143	.....	121	.....	.....	.....	54	.....	.....	.....	275	.....	.....	92	.....	.....	147	.....	147	112	77	62
Mt. Carmel, Maysville road	4,311	do	T. H. Kingsbury	.....	.....	.....	.....	.....	265	152	131	160	215	183	124	285	204	163	165	219	200	252	.....	96	.....	296	.....	281	.....	.....	.....	.....	.....	252	.....	167	.....	.....	.....	135	.....	.....	.....	180	.....	.....	248	.....	.....	169	.....	270	221	188	167
Canton, S. Main St. road	6,564	do	Leola Bucklew	.....	.....	.....	.....	.....	287	217	220	122	215	343	371	343	374	343	444	395	672	385	.....	346	.....	249	.....	374	.....	1197	.....	.....	.....	385	.....	386	.....	.....	.....	146	.....	.....	.....	338	.....	.....	384	.....	.....	292	.....	302	413	362	295
McLean	532	do	Mrs. Hattie L. Van Ness	.....	.....	.....	.....	.....	.....	.....	.....	.....	123	106	171	128	138	141	131	191	180	85	.....	173	.....	153	.....	143	.....	.....	.....	.....	.....	148	.....	110	.....	.....	341	83	.....	.....	.....	225	.....	.....	123	.....	.....	70	.....	94	106	108	94
Bloomington, S. Main St. road	23,286	do	J. D. Baird	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	225	.....	338	229	235	216	185	263	168	.....	282	.....	368	.....	321	.....	477	.....	.....	.....	288	.....	283	.....	.....	.....	147	.....	.....	.....	220	.....	.....	253	.....	.....	156	.....	238	225	206	224
Salem	1,642	do	Earl Estes	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	148	217	221	150	142	164	185	122	.....	125	.....	260	.....	198	490	.....	.....	.....	197	.....	197	.....	.....	.....	89	.....	.....	.....	205	.....	.....	206	.....	.....	222	.....	326	189	135	130
Carlinville	3,502	do	Edna A. Chiles	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	163	246	130	141	135	163	146	64	.....	499	.....	204	.....	150	.....	.....	.....	.....	.....	191	.....	155	.....	.....	.....	10	.....	.....	.....	142	354	.....	121	.....	.....	101	.....	198	185	130	125
Princeton, North road	4,023	Gravel	Bertha Stein	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	206	357	350	237	327	288	269	319	.....	426	.....	255	.....	367	.....	1113	.....	.....	.....	321	.....	297	.....	.....	.....	190	.....	.....	.....	275	.....	.....	346	.....	.....	156	.....	173	169	260	200
DeKalb, Malta road	5,904	Earth	Joseph Carroll	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	167	214	219	135	142	179	197	153	.....	155	.....	227	.....	156	.....	.....	.....	.....	.....	205	.....	296	.....	266	.....	115	.....	.....	.....	176	.....	364	184	.....	.....	92	.....	120	127	241	126
Dixon	7,197	Macadam	Mrs. W. H. Ruppert	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	313	415	341	297	285	268	329	331	.....	345	.....	416	381	323	.....	.....	.....	.....	.....	308	.....	363	.....	.....	.....	318	.....	.....	.....	367	.....	.....	407	.....	.....	300	.....	279	294	387	278
Rochelle	2,073	Gravel	Lida Holmshade	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	273	254	257	257	289	294	237	181	.....	248	.....	328	.....	316	.....	.....	.....	.....	.....	211	.....	260	.....	.....	.....	277	.....	.....	.....	260	.....	.....	272	.....	.....	161	.....	259	352	293	235
Freeport, N. Galena road	13,258	Earth	Mrs. John Schiller	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	177	228	141	139	159	155	88	.....	199	.....	236	.....	179	.....	.....	.....	.....	.....	208	.....	247	.....	.....	.....	189	.....	.....	.....	220	.....	.....	242	.....	.....	165	.....	207	222	213	265
Galena, Hazel Green road	5,005	Macadam	Flora Hoelting	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	171	167	113	117	149	163	.....	198	.....	177	.....	112	.....	.....	.....	.....	.....	160	.....	148	.....	457	.....	184	.....	.....	.....	121	.....	.....	162	.....	.....	104	.....	164	104	.....	79
Galva, South road	2,682	Earth	Ruby C. Lindquist	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	108	75	117	68	.....	136	.....	190	.....	183	.....	.....	.....	.....	.....	128	.....	157	.....	.....	.....	47	.....	.....	.....	131	.....	.....	142	.....	.....	94	.....	73	73	112	48
Galesburg, Wataga road	18,607	do	Ellen Holmes	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	130	.....	147	.....	136	.....	.....	.....	.....	.....	139	.....	262	.....	.....	.....	61	.....	.....	.....	142	.....	.....	191	.....	.....	53	.....	107	85	192	92
Champaign	9,098	do	J. Pancoast	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	162	.....	242	.....	220	.....	.....	.....	.....	.....	188	.....	116	435	.....	.....	79	.....	.....	.....	204	.....	.....	187	.....	.....	106	.....	140	179	98	74
Aurora, Galena road	24,147	Gravel	G. B. Barclay	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	210	.....	278	.....	306	.....	.....	.....	.....	.....	248	.....	220	.....	.....	.....	103	.....	.....	.....	165	.....	.....	229	.....	.....	109	.....	245	189	207	140
Geneseo, Billy Wolf road	3,356	Earth	Wanda M. Wolf	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	128	.....	106	.....	.....	.....	179	.....	.....	.....	140	.....	.....	194	.....	.....	134	.....	133	120	237	108
New Lenox, Joliet road	481	Gravel	O. C. Dickinson	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	52	.....	71	.....	.....	.....	28	.....	.....	.....	56	.....	.....	50	.....	.....	41	.....	52	35	44	30
Orland	366	Gravel and earth	Henry Kott	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	78	.....	.....	.....	115	.....	.....	121	.....	.....	77	.....	78	133	130	106
Mendota	3,736	Earth	Harry Weygandt	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50	.....	.....	.....	92	.....	.....	138	.....	.....	107	.....	113	170	201	108
Rock Island	19,493	do	Ruth Y. Farthing	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	389	.....	.....	381	.....	.....	239	.....	292	362	339	178
Springfield, Peoria road	34,159	do	Ruth Brooks	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	122	120	90	67

From the table it will be noticed that traffic has been taken on special occasions, such as when a circus was in town or whenever a similar important event took place. On such days the observers were instructed to take a count of the traffic whether or not it was the regular day for taking the census. The figures thus obtained, it is believed, show the maximum use that is made of a particular road, and it is therefore intended to show what may be considered as the maximum amount of traffic. Thus we find on July 12th on the road into Greenville a total of 1,283 vehicles, while the average traffic at this time of year is but 340. Likewise on Sept. 6th on a road into Canton 1,197 vehicles were counted, while the average at this time of year is about 380 vehicles.

There is also to be found from a study of the individual reports a great variation in the hour of the day when the maximum traffic occurs. Thus the traffic in Elgin is fairly well distributed throughout the middle part of the day, while the traffic to Peoria occurs between 7:00 and 9:00 a. m. coming in, and 2:00 to 4:00 p. m. going out. The most marked hourly variation in traffic occurs on the road to Elburn. At this point each report shows a large amount of traffic between 8:00 and 9:00 a. m. going to town and between 9:00 and 11:00 a. m. leaving. These are instances where it is necessary for the business of a community to use the road not only every day in the year but at a certain hour of the day.

As before stated, the data here presented is not considered complete and, therefore, conclusive deductions should not be drawn without additional records. It seems, however, that the evidence furnished warrants making some general observations. A country road is well traveled that has a daily average in fair weather of 300 vehicles or over; 600 vehicles a day is an exceptionally large traffic, and over 1,000 vehicles of very rare occurrence. The majority of the vehicles are reported drawn by two horses, seldom by more than two.

The greatest variation in the use of the roads seems to be about stations where there are nothing but earth roads which necessarily become extremely bad in winter and spring. It is a practical impossibility in the vicinity of Springfield, for instance, or other places with similar road conditions, to engage in business pursuits which require the daily use of the roads such as is made of them about Elburn, Elgin and Rockford. The condition of the roads about the latter places is such that business can be done daily with certainty. It may be said, and possibly it is true, that the business about Springfield and other points does not require the daily use of the roads, but it is also true that these communities could not engage in any pursuits that would require such a use of the roads in their present condition.

ROAD IMPROVEMENT ASSOCIATIONS.

Realizing the inadequacy of the public road administration, the citizens of a number of communities have formed road improvement associations whose object is to secure some special road improvement. A few of these associations have come under the notice of the State Highway Commission, and it is believed that an account of their work will prove instructive.

It is hoped that a more complete list of the road associations can be secured than the short time available has permitted. The records of these associations and an account of their work would form an important chapter in the history of public road improvement and would be exceedingly helpful to other communities who have some such organization in mind. If the records and information are available, they will be made the object of a special bulletin at some future date. In the meantime anyone having knowledge of such an association is particularly requested to report the same at once to the State Highway Commission at Springfield, Ill.

Smithton Township Good Roads Coöperative League.

The Smithton Township Good Roads Coöperative League, of Smithton, St. Clair county, offers an illustration of a well organized attempt for local road improvement. At the special request of the commission, Dr. G. G. Bock, president of the league, submitted the following account of its work, which is here printed in full:

The impassable roads of the spring of 1903 caused the people of this vicinity to consider ways and means to overcome this great obstacle. A good roads league was suggested and favored by the people in general. A meeting was called on March 21, 1903, and accepted the following resolutions:

Whereas, About the same method of working our public roads has been practiced for about fifty-one years without producing any appreciable results in the betterment of our highways, and

Whereas, Our public roads are and have been in such a bad condition this winter as to constitute a menace to public welfare, and even endanger the life of man and beast; be it, therefore,

***Resolved*, That we, the people of Smithton township, in convention assembled, petition our public highway commissioners at the ensuing annual town meeting, to coöperate with the village authorities in purchasing macadam for hard roads in large quantities, and instruct them to commence mending the worst places in various parts of the township with same. Be it, therefore, further**

***Resolved*, That 25 per cent of the money appropriated for roads and bridges annually be set aside for improving the worst places on our roads with hard material.**

A. Dragged Road. Maintained by Galva Good Roads Improvement Association.

B. Unimproved Earth Road, Near Galva, Henry County. Taken Same Day as View A.

The following constitution and by-laws were drawn up and circulated with a list for subscribers at the annual town meeting, and was signed by almost everyone present that day:

Constitution and by-laws of the Smithton Township Good Roads Coöperative League:

Article 1. Name, Smithton Township Good Roads Coöperative League.

Article 2. Object—The object of the league will be to, in every possible manner, improve our public or common roads, by holding not less than two public meetings annually in various parts of the township for the purpose of discussing questions pertaining to the improvement of the roads, and coöperating with all organizations who are laboring for the permanent betterment of our public roads, and especially to labor and vote for men who will assist in working to improve the worst places on our roads in a permanent manner.

Article 3. Officers. The officers of the league shall consist of a president, vice president, a corresponding secretary and recording secretary, elected at the annual meeting of the league; said officers to hold their positions until their successors are elected.

Article 4. Duties. It shall be the duty of the president to preside at all meetings of the league. It shall be the duty of the recording secretary to keep correct record of all meetings in a book to be provided for the same. It shall be the duty of the corresponding secretary to conduct the correspondence of the league.

Article 5. Committee. There shall be a standing committee of three members appointed for the purpose of executing the orders of the league, and transact any and all business that will be referred to it.

Dues. There shall be no membership fee required of those who join the league.

Assessments. No assessment will be required other than sufficient to conduct the correspondence of the league.

On May 28, 1903, at a meeting, the constitution and by-laws were adopted, and permanent officers elected with the following result: Dr. G. G. Bock, president; Phil Brandenburger, recording secretary; A. M. Carr, corresponding secretary; Wm. Brenner, A. A. Miller and G. F. Phillips, committee on general business.

All the work accomplished by the league was as its name implies, on a coöperative plan. Willing citizens of the village of Smithton donated small sums of money, or put in a day's work at a hill or wherever necessary. The Reichert Milling Company of Freeburg donated $15.00 to cut down a hill leading to said mill in adjoining township. The Western Brewery sent $10.00 to be used on cutting a certain hill. Mr. Johnson, a mine operator, gave $3.00 and assisted with team for hill near his mine. In return the league put up signs at various places giving names of donators and all who helped free of charge.

Colored placards were posted along the roads calling attention to the bad drainage, the steep hills, poor bridges, etc., etc., constantly reminding the passerby of the necessary improvements that should be made. Circular letters were occasionally sent out inducing coöperation in the good work. Our county papers agitated the good roads question by publishing articles encouraging neighboring townships and counties to further the welfare of the community by coöperating in the work so faithfully undertaken in our township. The last new work undertaken by the league was the building of permanent bridges, and has succeeded in building two of them, which will no doubt prove that good substantial work is the cheapest in the end.

Galva Good Roads Improvement Association.

Another association which has accomplished much practical work is the Galva Good Roads Improvement Association, of Galva, Henry county. The special object of this association was the dragging and

general maintenance of the main roads leading from Galva. This association accomplished excellent results and the roads maintained by it could well serve as model earth roads. The following is an account of the formation of the league and its objects as submitted by the chairman of the association, Mr. John Miller, of Galva. Plate 1 shows a road that has been maintained by the league and also one in the immediate vicinity which has not been so maintained. The contrast is marked.

At the close of the Galva Farmers Institute last year at which the subject of good roads was thoroughly discussed the institute officials immediately took steps to organize a road improvement association, as follows:

Galva Institute Road Improvement Association. For the purpose of improving the wagon roads adjacent to Galva, the undersigned agree to give the sum opposite their names, the several amounts when aggregating $80.00 to be divided into three premiums, $40.00, $25.00 and $15.00, to be awarded on the three best four-mile stretches of main road leading out from Galva, distance to be measured from the corporation line out, roads to be graded or put in proper shape to be worked with the road drag through the season, the season to begin May 1st and end Jan. 1st.

In a very short time the money was subscribed and then the farmers living on the different roads were asked to organize under the following agreement:

> We, the undersigned, living on ..... road, agree to do our proportionate share of work necessary to carry out the scheme of the Galva Road Improvement Association.

More than thirty miles of road were graded on the seven main roads. A complete organization was effected on but four covering eighteen miles. More or less dragging was done on the other roads, but not on four-mile stretches. Widespread interest was created in good roads by this organized movement, and it culminated in a good roads meeting in March to be addressed by Engineer A. N. Johnson of the State Highway Commission, but owing to missing train connections Mr. Johnson failed to appear for the afternoon meeting advertised and it was impossible on short notice to get many farmers together for the impromptu evening meeting held. Interest had been thoroughly aroused, however, and suffered no abatement. Three judges were appointed to go over the roads after each rain to see that the roads were properly worked, the manner of judging being according to the following scheme of points adopted by the association:

Crown or cross slope 30 points, dragging 50 points, approaches to bridges 10 points, general appearance, weeds, rubbish, etc., 10 points. Judges permitted to make sub-divisions if desirable.

The results of the movement up to the present time, October, have been gratifying to everybody concerned, farmers, business men, and road officials, and it is conceded on every hand that better results have been obtained from the funds this year than ever before.

The subject of tile drainage in the highways received more attention this year than ever before, and good results are expected from the tile laid this year. It is believed that the policy of under draining the highways will be continued until the necessary under drainage is completed.

The road association had had the active coöperation of the commissioners of Galva township, H. A. Calhoun, Jonas Grumell, and Isaac Johnston, and also of Wm. Beals, F. B. Barlow, G. A. Quick, commissioners of Lynn township, Knox county. It is reported that the commissioners of Lynn township have made arrangements for the construction of a concrete bridge under the supervision of the highway commission, with crushed rock furnished at a cost of 75 cents (freight) per ton from the State penitentiary crushing plant. This new departure in bridge and culvert building will be watched with a great interest by the farmers and road officials of Knox county and Henry county.

The great benefit from the good roads movement in Galva is in the awakening of the farmer to the fact that a well drained road, well kept, is pleasant to drive over and an actual financial benefit to the adjacent land owner.

GALVA FARMERS INSTITUTE ROAD COMMITTEE,
JOHN MILLER, *Chairman*,
E. S. DEAN, *Pres. of Farmers Institute*,
JOHN CAIRNES, *Secretary*.

FULTON COUNTY HIGHWAY COMMISSIONERS' ASSOCIATION.

In Fulton county there is an association somewhat unique in this State, which is composed of the highway commissioners of the county and which is known as the Fulton County Highway Commissioners' Association. The purpose of this association is to discuss road matters and questions that come under the notice of the highway commissioners. While the actual accomplishment of such an association may not be noticeable practically, yet it can have a tremendous moral influence. It would seem that such an association should exist in every county and that the commissioners should attend meetings at least once a year, oftener if possible, for a thorough discussion of various points that come up in their work. These associations could not fail to rouse increased interest in their work, which would necessarily result in their being more efficient public servants.

BLACK HAWK GOOD ROADS ASSOCIATION.

Early in the spring of 1906 the citizens of Black Hawk township, Rock Island county, formed what is known as the Black Hawk Good Roads Association. The object of this association is fully explained by its by-laws, which are as follows:

Section 1. The name of this association shall be the Black Hawk Good Roads Association.

Sec. 2. The object of this association shall be the improvement of the public highways in Black Hawk township.

Sec. 3. Any resident of Black Hawk township or person who is a tax payer herein shall be eligible to membership in the association upon signing his name to the membership list and agreeing to assist towards the improvement of the public highways in Black Hawk township.

Sec. 4. The officers in this association shall be a president, one vice-president from each highway district, who shall be the highway commissioner, a secretary and treasurer, all of whom shall be elected annually.

Sec. 5. The duty of each officer named shall be the duties usually belonging to the respective positions. The vice president shall also have general charge of road improvements in their respective districts, and it shall be their duty to secure the aid of each resident in such district.

Sec. 6. It is understood that nothing in these by-laws is to be construed as in any way conflicting with the power and duties of the regularly elected highway commissioners, it being the purpose of this association to assist them in every way possible to improve the public highways.

Sec. 7. No officer shall draw any salary. Any actual expense incurred by and with the consent of the association shall be paid out of any funds in the hands of the treasurer upon orders signed by the president and secretary.

Sec. 8. Such funds as may be received by contribution or otherwise shall be expended for legitimate and necessary expenses in the manner herein prescribed, except that such funds as are donated for a specific purpose shall be expended for the purpose desired.

Sec. 9. The particular object of this association is the improvement of the highways by such methods and with such material as can be furnished or secured by the members without incurring heavy expense, and will recommend that members and general public make and use regularly the King split log road drag as the cheapest device for the improvement of dirt roads.

Sec. 10. The annual meeting of the association shall be held at Milan on the second Saturday in March at 2:00 o'clock p. m. Special meetings may be called by the president or any three members may sign a call for a special meeting, then it shall be the duty of the president to call such meeting. Any expense that is incurred in calling such special meeting shall be paid by those signing the call for the meeting.

D. W. MATTHEWS, *President*,
R. E. LITTLE, *Secretary*,
F. H. CALDWELL, *Treasurer*,
JAMES DICKSON,
MICHAEL KANE,
GUS DANIELSON,
Vice Presidents.

F. H. CALDWELL,
R. E. LITTLE,
JOHN S. MCCONNELL,
Committee.

A. Typical Limestone Macadam Roads Near Rockford, Winnebago County.

B. Uusual Method of Spreading Gravel which is Left for the Traffic to Smooth and Compact. Road Near Elburn, Kane County.

SPECIAL ROAD CONDITIONS.

Although by far the great majority of roads in the State are in bad condition and a large portion of the funds annually paid for road purposes does not seem productive of any real results, there have been, however, in some sections of the State very gratifying results which will be described briefly. While a description of road conditions and road construction in other states and other countries is interesting, yet the effect is not the same as a description of road construction carried on under the conditions actually found in Illinois.

Macadam Roads near Rockford.

In the vicinity of Rockford some good macadam roads have been constructed. These roads and their method of construction were carefully inspected. The roads are among the best macadam roads in the State. Considerable care is exercised in locating the macadam in the center of the right of way, which is usually graded for a width of sixteen feet and carefully rolled. There has been considerable macadam laid twenty feet wide. The roadbed, however, is generally more or less flat rather than crowned; the crown of the road is accomplished chiefly by placing material thicker in the center than at the sides. Most of these roads are of the telford construction, that is, the lower course consists of large stone or rubble, which is about four inches thick at the edge and increases in thickness towards the center. The earth is graded from the gutters to the edge of the stone and rolled, making an earth roadway on each side which is much traveled during the dry season of the year. The soil is a black loam, which compacts well and affords a good earth drive. As these earth side roads become worn they are regraded and kept in good condition throughout the year. No data as to the exact cost of these roads could be obtained. Plate 2-A shows a limestone macadam road near Rockford.

Gravel Roads.

Many sections of the State are well provided with gravel, and this has been used on the nearby roads. These roads, for the most part, become good gradually; that is, the first application of gravel does not, as applied, give the best results, which are not obtained for perhaps one or two years. After a number of applications of gravel have been made and the traffic has had an opportunity to spread and compact it in an even manner, which it eventually does, very satisfactory roads result.

In the vicinity of Aurora are to be found good gravel roads. The gravel is placed usually for a width of ten to twelve feet at one side of the road. It is flanked by an earth driveway, which gradually becomes somewhat worn below the surface of the gravel, there frequently being a sort of terrace formed between the two which is sometimes too steep to drive over conveniently. The usual method of constructing the gravel roads is merely to dump two loads of gravel side by side along the road and allow the traffic to do the rest. This method of placing the gravel is shown on Plate 2-B. Good results from the use of the gravel could doubtless be accomplished sooner if it was harrowed, as spreading in this way would bring the larger material to the top and allow the sand to sift through to the bottom. It should then be rolled and covered by a thin layer of smaller gravel, which would serve as a binder. In this way a smooth road could be had from the beginning and the wagons would not have to make the road. It is also necessary that the gravel roads be repaired constantly to fill in the chuck holes which form, due to the uneven distribution of the various size pieces which go to make up the bulk of the gravel. Unless careful attention is given to this, a gravel road will become very uneven and full of holes.

There have been extensive stretches of gravel roads constructed in the vicinity of Quincy, in Adams county, and also in Bureau and LaSalle counties, as well as at various other points where gravel is found. The distribution of gravel is fairly well shown on Figure 19.

It is somewhat difficult to ascertain the cost of completed gravel roads, owing to the fact that records are not kept by the commissioners in such a way as to show clearly just what a given piece of work has cost. Also, as it is usually necessary to apply the gravel more than once in order to get a good stretch of road, the first cost should not be taken as the cost of the completed road. The first cost of placing gravel on the road, which may probably be done for $1,000.00 a mile, is often quoted as the cost of the road and would lead another community to suppose that if they once had the gravel at hand this would be perhaps the whole cost, whereas it will prove upon examination that it was necessary to do additional work at other seasons in order to bring about good results.

At Monmouth an exact account was kept by the local commissioners of the cost of the construction of the gravel roads, which were made for a width of fourteen feet, with four inches of crushed stone surfaced with four inches of gravel at the edge and eleven inches at the center. On 2,000 feet of road there were used 869 cubic yards of gravel and 337 cubic yards of stone. The gravel cost 57½ cents per cubic yard on the cars at the pit and the freight was 82½ cents per cubic yard. The stone was hauled five and one-half miles in wagons and the gravel an average of two and one-half miles. The total cost, as reported for the 2,000 feet, was $2,200.00, or $5,808.00 per mile.

On another gravel road built near Monmouth the cost per hundred feet fourteen feet wide was reported to be $134.00, or $7,075.00 per mile. On both of these roads, however, the cost was much increased by the fact that the gravel had to be shipped by rail.

A. Brick Road, Near Monmouth, Warren County.

B. Plank Toll Road, Near Belleville, St. Clair County.

Brick Roads.

What is said to be the first country road to be paved with brick was constructed near Monmouth. A number of other roads have since been paved with brick, making about six miles in all. Some of the first work was done apparently without taking enough care with the foundation, as is evident by the unevenness of this part of the work. This fault has been corrected in the pavement recently constructed. A section built on the road to Galesburg will serve as an example. The construction of this road was begun July 24, 1905, and was completed the first of the following October. The length of the road constructed was 3,400 feet. The road was paved for a width of nine feet with brick, on each side of which was a strip of macadam two and one-half feet wide. The sub-grade of the road was brought to proper shape and a three-inch layer of crushed sewer pipe was laid and rolled, on either side of which was placed a curb board which was four inches wide and one inch thick, held in position by stakes driven on either side. A layer of sand two inches deep was spread and carefully shaped, on which were laid the brick, which were 3"x4"x8" in size. The joints were filled with sand and the entire center of the road, including the macadam shoulders, was rolled with a seven-ton horse roller. The earth road was graded to the gutters with the same contour of the finished crown of the pavement.

The total cost of this work was reported to be $5,247.99, or about $1.65 per lineal foot. On Plate 3-A will be seen a view of this brick road.

Much experimental work in road building has been done in the vicinity of Monmouth, in the construction of stone and gravel roads. Other brick roads have been constructed which cost about 90 cents per lineal foot. The brick were laid for a width of seven feet, with a two-foot strip of macadam on either side, making a total width of eleven feet. This was considered by some to be too narrow.

During the discussion on this question, a Mr. Burford of Monmouth made some practical tests as to the number of times he had to turn out on a five-mile drive on the Rock Island road for thirty days. It averaged once a mile, and allowing three rods for each turn-out, he was off the road only fifteen rods in five miles.

Toll Roads.

In the vicinity of Belleville, St. Clair county, there are two or three toll roads. Special effort has been made to find out the exact number of toll road companies and the capital stock, income, expenses, etc. So far, however, it has not been possible to obtain this information. One of these roads, which leads from Belleville to Smithton, is instructive, as showing exactly what a community will pay for even a very poor kind of road, if it will only keep them out of the mud. This road, which is between six and seven miles in length, is for the most part a plank road. The planks are laid on sills which are about eight feet apart. In some places where the planks have broken through they have been replaced by some crushed rock, which has been thrown on in promiscuous fashion.

Dr. G. G. Bock, president of the Smithton Good Roads League, reports that the total amount of tolls collected on this road is about $3,200.00 a year, or approximately $500.00 per mile a year. The road is so rough that the earth road at the side is used all seasons of the year except in muddy weather. A portion of this road is shown in the cut on Plate 3-B. Owing to the high price of lumber, it is probable that this will be the last of the plank roads, which makes this road of additional interest.

EARTH ROADS.

Present Methods of Maintenance.

There in the State approximately 86,277 miles of earth roads, which are 92 per cent of the total road mileage. Roads of this character will constitute a majority of all the roads in most communities for a long time to come, so that the proper care and maintenance of earth roads as earth roads is a most important consideration.

Before passing to particular methods that should be followed in the construction and the proper maintenance of earth roads, it is well to consider the methods that are in vogue and the results obtained. From the reports of the township commissioners from all over the State and from reports made by over 1,400 letter carriers, representing a little over 33,500 miles of road, together with personal inspections made in different sections of the State and information received from other sources, a very reliable idea of the work generally done has been gained together with results obtained. Practically all of the road work is done when there is little for teams to do at farm work. A majority of the highway commissioners are themselves farmers, and could not give attention to the road work at other seasons. The result is that the earth roads are worked for the most part in exactly the time of year when the least good can be done. Indeed much of the work done on the roads, aside from weed cutting, is a real detriment; and the roads would be in no worse condition, and probably better, had they been left alone and no money expended on them.

Everybody knows that dry clayey soil can not be made compact and hard while dry; that it only becomes so when thoroughly mixed with water and allowed to dry out. At the season of the year when the roads are worked the road-bed proper has become so hard that the road machine or road grader, the implement generally used for shaping up the roads, can secure material only far out on the edges of the road where the sod and weeds have probably taken root. These are scraped off together with some loose earth and the whole mass is piled in the center of the road, the height and shape depending on the ingenuity of the one who operates the grader. In some cases an amazing slope is given to the road which causes traffic to seek the more level portion near the ditches. This mass of loose earth, whatever may be its shape, does not shed water but absorbs it. The mud is mixed and worked up by the traffic into ruts and chuck holes which are practically lined with water tight puddled earth. These ruts and holes re-

tain the rainwater until it is evaporated, but little soaking away. The result is not only an extremely muddy road, but when the roads do dry out they are quite as uncomfortable and about as impassable for practical use. On many roads this condition lasts nearly the summer through. The cut shown on Plate 4-A is a picture of a road taken in July, 1905, which has remained rough and uneven. There are two things, therefore, to accomplish in the maintenance of our earth roads, to render them less muddy in wet weather and to have them dry out and be smooth in good weather. While it may not be possible to avoid the mud altogether, experience has shown that this can be done to a great degree, and there is no question that roads can be maintained so that they will dry out much sooner and keep in smoother and finer condition eight or nine months in the year.

Proper Methods Must be Simple.

There are cerain fixed requirements that any method of maintenance must fulfill to be of practical value in the upkeep of earth roads generally. Whatever is used it must be simple, efficient and economical. It is proposed to give a brief outline of a few principles which fulfill these requirements and which are not in such general use as they should be. It is not intended to give an exhaustive treatise of the subject of earth road building, or to enter into the discussion of engineering problems which govern the location and establishment of gradients. Such information can be applied only in the light of engineering ex perience, and those who have this experience can find already at hand engineering works which treat this subject perhaps as well as such a subject can be treated. The application of general principles is a matter that requires the exercise of judgment in each instance, and while these principles might be discussed at great length they would be of small value except to those who have had special engineering training. It is, therefore, proposed to confine this chapter to such suggestions as can be applied readily by highway commissioners and others interested in road improvement who would not, however, make any use of an engineering treatise.

Steep Hills Should be Cut Down.

The first principle to be laid down is that if an earth road has steep grades, that is, steep hills, they must be reduced, and engineering assistance is necessary in laying out the work. It may be found that the hills can be entirely avoided by relocating a short section of the road; again, this may be impracticable. Filling up the hollows and providing for proper drainage, the size of culverts necessary for this drainage, are all questions which concern the permanent construction of a road and should receive careful attention.

The cost of a line of levels to give the profile of the road so that a proper grade can be built is but a few dollars and is saved many times over in the cheapness of the work later. In this way the amount of cut or fill at each point on the road is known and the work can be laid out so as to avoid over-hauls and rehandling material, which is sure to be

A. Rough Earth Road in July, Near Springfield, Sangamon County.

B. Earth Road Maintained by a Drag. Clear Lake Road, Near Springfield, Sangamon County.

the case if one attempts to grade a hill "by eye." Assuming, however, that the road is permanently located, has proper grades, and is provided with culverts and bridges, there is still the problem of what is the best manner of maintaining such a road.

Sandy Soils.

The character of the soil is the first thing to be considered. If sandy, no attempt should be made to round up the road, as it is a benefit under such conditions to retain as much moisture as possible. Also, if it is a lightly traveled road, it is possible that sod and weeds will take some hold and these should not be disturbed. In fact, unless some radical change can be made, the less that is done to a sandy road, the better for the road. Such a road is good in wet weather and poorest in dry weather, exactly the reverse of the conditions to be met with in most other soils.

Sand Clay Roads.

If clay is in the vicinity of a sandy road, this offers the cheapest method of improving the same. Clay is hauled on the road and harrowed in with the sand until a mixture of the two is obtained. When this work is done in wet weather the traffic will soon mix thoroughly the sand and clay, and it is then only necessary to keep the surface of the road smooth until it dries out, when it will become hard and make a very satisfactory road surface. If the road becomes a little sticky on top in wet weather it should be sprinkled over with some sand. If it becomes sandy on top in dry weather it shows the surface has not enough clay mixed with it, and a small amount of clay should be added. In most sandy soils there is very little trouble to provide drainage, as such soils are naturally well drained.

Clay Soils.

But by far the larger part of the earth roads in Illinois is over a clay or black or brown loam soil which becomes sticky when wet, and if mixed up or puddled, forms when dry an extremely hard mass. Only a small amount of water is sufficient to make roads of this character very unpleasant for travel and, in many cases, quite impassable. All of these soils do not possess the same degree of stickiness when wet, or, in the language of the clay worker, are not equally plastic. Perhaps the stickiest soil is the black gumbo soil which has when wet a glue-like tenacity and adheres to everything that comes in contact with it. It is not at all uncommon for this black sticky mud to fill in completely between the spokes of the wheels and to choke the space between the wheels and the wagon body so that it is impossible for the team to turn them.

While the roads over lighter clay soils are bad enough and frequently impassable in wet weather, they do not perhaps become so bad as those over black, sticky, gumbo soils. It is evident there is one thing that makes these roads bad, and that is the presence of water. Therefore, it is necessary to devise means to keep the water as far as possible out of the road, or, if it has come into the road, to render its action less harmful.

Drainage.

Drainage, therefore, is the first requisite in maintaining earth roads. To describe exactly how this is to be accomplished in each case is practically impossible, but there are a few general rules which apply.

Under Drainage.

There are two kinds of drainage, what may be called under drainage and surface drainage. Under drainage provides for water that has seeped through the soil from some distance away and comes up close to the road surface from below. Under drainage is necessary in every road, but in some soils which are more or less porous this is provided for naturally. In other cases it may be that the underground water does not rise near enough to the surface of the road to require consideration, but where it does artificial under drainage must be provided.

This is done by laying tile drains which are carried to the nearest outlet available. The presence of underground water can be usually determined from evidence found in the road itself. Wherever there is a seep hole or when the road surface quakes under the action of traffic underground water is present too near the surface of the road and must be removed before the road can be maintained in a proper manner. Sometimes a fairly solid crust will form over such places, but the evidence of an insecure foundation can usually be detected when a heavy wagon passes.

There are a few general rules which should be followed in laying a tile drain. It should be laid three or four feet below the center of the road, so that if there is a crown of 12 to 18 inches, which would depend on the width, this would bring the tile drain when laid at one side of the road from two to two and a half feet below the surface of the ground. The tile should be laid at that side of the road which gives evidence of most underground water. But one line of tile should be laid at a time; if it is found that the line of tile first laid does not drain the opposite side of the road sufficiently, the second line should be put in. Tile should be laid in a straight line and true to grade. The bottom of the ditch must be cut to the exact grade line. This requires a trifle more work, but it is absolutely necessary to do this if the tiling is to be a success. When a road tile is laid which would be a convenient outlet for farm tiles, the farmers adjoining should be notified and given an opportunity to pay what extra cost would be necessary to lay tile in the road large enough to accommodate farm drainage, and proper connections provided for when the tile is laid. Ordinarily for road drainage alone six inch tile is ample, but if farm drainge is to be provided for, two or three times this size may be necessary.

Only a very slight fall is necessary for the successful working of a tile drain if carefully laid. Drains with a fall of one inch to the hundred feet will give good results if well laid. Long lines of tile drain should not be laid without first having an accurate line of levels run and stakes set every fifty or hundred feet on which is accurately marked the exact distance down to the bottom of the tile. If the length to be laid

is short and there is a good fall, no levels are necessary as the line and grade of the drain can be readily sighted without instruments other than sticks with cross pieces nailed on them.

Surface Drainage.

No kind of road is more comfortable or better suited for ordinary traffic than an earth road in good condition, but from the very nature of the material from which it is usually constructed, such road does not remain in good condition for any great length of time without attention.

The first principle to keep in mind in the maintenance of earth roads, if the best results are to be obtained, is that they must have constant attention. Earth roads of clay or gumbo soils are not improved if the surface is disturbed when they are dry. The time to remove the holes and ruts in these roads is when they are muddy. But before the surface of the road is ready to receive special treatment, it must be put in proper shape and the side ditches properly made to take care of the surface drainage. It is the lack of surface drainage that is the chief cause of the extremely bad condition of the road in wet weather. The surface is full of holes and ruts which have been stamped into the sticky impervious soil which retains the water. Traffic merely mixes the water with the soil with much the same result that a pug mill has on clay. The first thing, therefore, to do in the maintenance of earth roads, assuming that the hills have been properly cut down, is to get a proper cross slope to the road surface.

Width and Cross-Slope.

The width of the roadway which is to be maintained for the use of traffic need not be over twenty feet. On the outside of this twenty feet should be shaped the gutters to carry the surface water. The center of the road should be at least twelve inches higher than the edges, and the gutters should be eighteen to twenty inches below the center of the road, depending on the width. Figure 10 shows the cross sections for earth roads under different conditions. In rolling or hilly country the width of the road should be as narrow as possible, so that the gutters will not have more water to take care of than is absolutely necessary. The extreme width of these roads would be twenty feet. The gutters should be made as shallow as possible, as shown in the diagram. In a flat country it is often very difficult to secure enough fall in the gutters to drain away the surface water. Under these conditions a road should be built up in the center as much above the level of the surrounding land as possible. This is accomplished by taking the material from the sides and throwing it to the center. The most expeditious way to do this is by use of the elevating grader, which elevates the material at the sides of the road and deposits it automatically in the center. The road is then shaped with the road machine and allowed to become compact with traffic, when it is ready to be maintained as will be described further on.

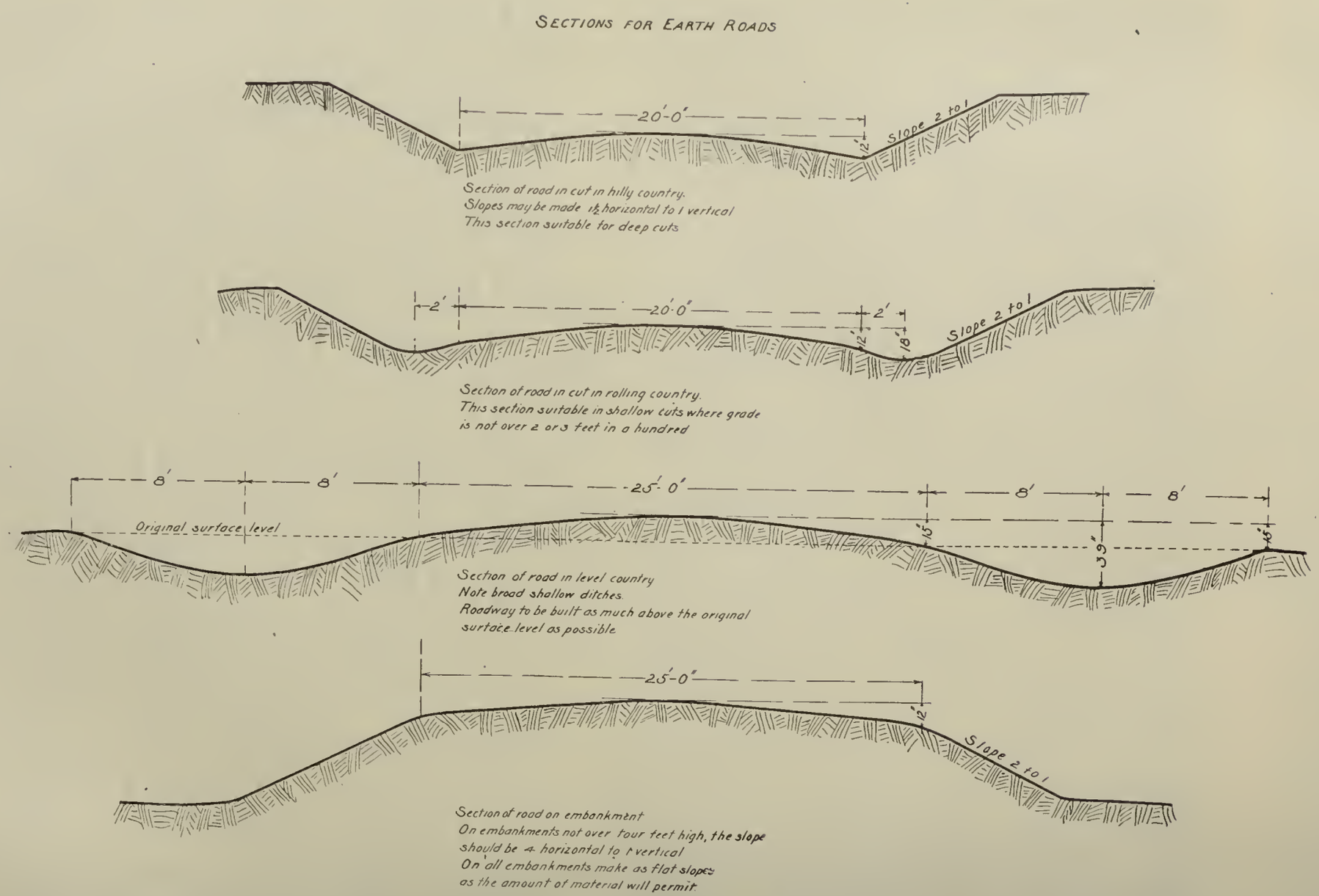


FIG. 10. Showing cross sections for earth roads

Figure 10 also shows the cross section for a road on an embankment. The roadway is made somewhat wider than through a cut in order to give a greater degree of safety, which is necessary because of the height of the road above the side ditches. A road on an embankment should be not less than twenty-five feet wide.

Water Breaks.

The greatest difficulty to overcome is to prevent the gutters on hillsides from scouring out and forming deep gullies. Where the materials are available to make proper water breaks in the gutters the wash can be very effectually stopped. Across the gutter should be constructed a small dam made of rock or concrete, which is lower in the center than at the sides. At the foot of the dam there should be an apron of concrete or cobble stones on which the water will fall. These small dams are constructed on the steep grades as often as may be necessary, and the steeper the slope the nearer together they should be. The gutters will then tend to fill up back of the dams or breaks, and the whole force of the water is expended in going over them and falling on the apron. Breaks or humps should never be built in the road surface itself.

Culverts.

There is scarcely a mile of road which does not require one or more small culverts to take the water from one side of the road to the other. The cheapest form of culvert is the vitrified pipe which, when properly laid, is durable. Vitrified pipe, however, must not be used where the outfall of the culvert is not sufficient to keep the pipe clear of water. If water backs up in the pipe and cannot run away it will freeze in cold weather and break the pipe. For this reason vitrified pipe in many sections has been discarded entirely for all culverts, when the pipe has broken solely from putting it in improperly or putting it in places where it should not be employed.

Both vitrified pipe and concrete culverts require to be covered by a layer of earth to protect them from direct contact with vehicles. Vitrified pipe should have not less than eighteen inches of earth covering, nor should it have less covering than the diameter of the pipe; that is, a two-foot pipe should have not less than two feet of earth over it. Where nothing but clay or black loam can be obtained to make the covering over the pipe there is danger in wet weather of the wheel working through the earth onto the pipe itself and thus cracking it. In such cases iron pipe had better be used.

In very level country where there is but little outfall, the best form of material for culverts is concrete. The tops of these culverts, if three feet or over in span, should be reinforced by steel rods, and this form of construction may be employed for spans from fifteen to sixteen feet.

The ends of both concrete and pipe culverts should be protected by a wall which is carried sufficiently below the pipe to prevent any scouring of the water underneath the culvert and thus undermining it. The end wall should be built not less than two and a half feet below the bottom of the culvert. Vitrified pipe culverts can be very effectually

protected by a layer of concrete which is put over the pipe as it is laid. Figures 11 and 12 illustrate how small culverts should be built. When there is sufficient head room concrete arch culverts may be used, but generally a flat reinforced concrete top is cheaper.

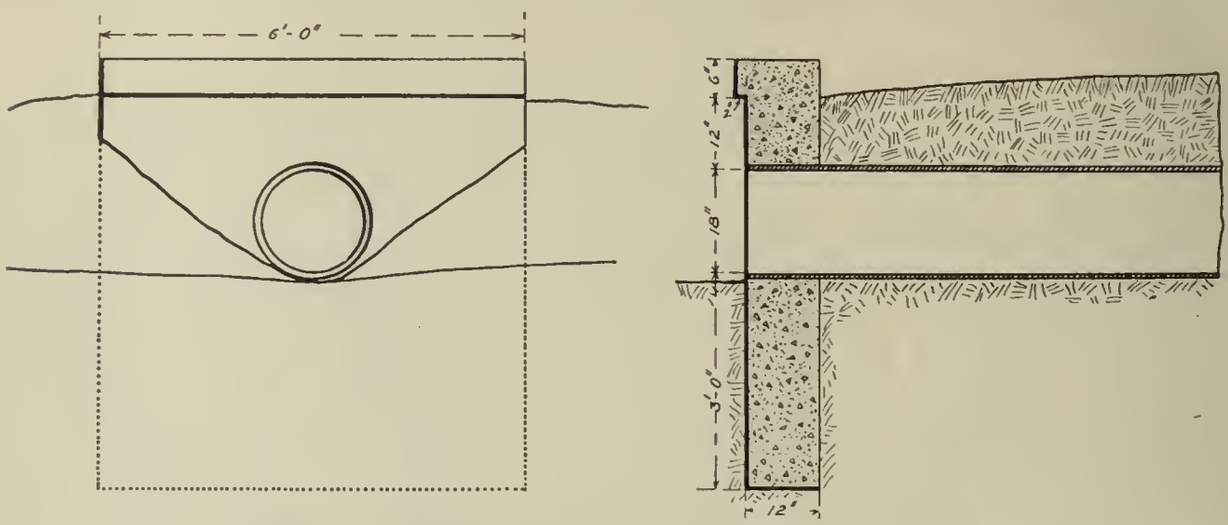


FIG. 11. Pipe culvert with concrete end walls.

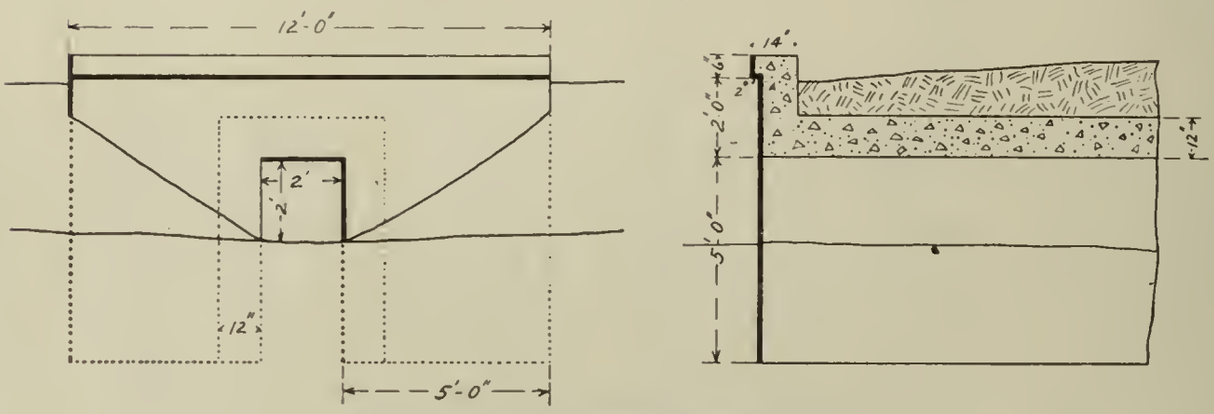


FIG. 12. Concrete box culvert.

Plank culverts should not be used. They are not only costly, requiring frequent renewals, but they are a source of constant danger. They usually become covered with a layer of earth so that the condition of the plank is not known until it suddenly breaks through, crippling horses if not causing a more serious accident.

The construction of large culverts should never be attempted without a properly prepared plan. Detailed designs for large culverts are not shown here, as each location demands some special feature which would not permit any specific use being made of a general plan. All township commissioners or other public officials who have occasion to build culverts in the public highways can get special information as to the proper design, cost, etc., without any charge, upon application to the State Highway Commission, Springfield, Ill.

CLEANING DRAINS.

The proper maintenance of earth roads requires that all drains shall be kept open and free. An inspection of all culverts, open drains, and, wherever they are accessible, under drains, should be made evey fall and spring, and they should be cleaned thoroughly of all sediment and trash that may have lodged therein.

Maintenance of Earth Roads with a Drag.

It has already been stated that the time to work the surface of an earth road is when it is muddy. A muddy road cannot be worked on with the ordinary road machine or road grader, but it can be worked successfully with the road drag.

Road drags have been known and used spasmodically here and there for many years, but it remained for Mr. D. Ward King, of Missouri, to show by persistent demonstrations the wide application and practical importance of the road drag.

Thousands of miles of mud roads can be bettered materially by following the direction for the simple method as here given. It will, no doubt, be necessary to under-drain many sections of road which may be dragged, but for immediate work the most essential thing to obtain is to have the surface of the roads reasonably smooth. This the road drag will accomplish.

If certain parts of the road break through the following winter, owing to improper drainage (and there is no doubt but that such failures will occur in many places), tile drain can be supplied wherever it is thus shown to be necessary. In the meantime little or nothing will be lost because drainage has not been provided for beforehand. In fact it is probable that much will be saved, as it will be found that under drainage is not necessary on all roads and would, therefore, have been so much work wasted.

The State Highway Commission urges every township commissioner to have all the mud and clay roads in his township dragged. For this purpose the commissioners could assign sections of road to the farmers living alongside and instruct them by telephone when they should drag. Each one dragging his section of road could be allowed so much time at the rates usually allowed per hour for a team and man. As soon as each one had dragged his section of road, he would report by postal card or telephone to the road commissioner that he had made a trip over his section of road and the commissioner would make an account of the work done. At the end of each month or quarter, those who had dragged their roads would render itemized bills to the township commissioner, who would check them against his accounts and make payment accordingly. Inasmuch as the time necessary to drag a mile of road need not actually keep a team from other uses for much over an hour, the expense per mile would be very small, even when the roads are dragged a number of times a year.

It is quite possible in many localities that the farmers would be sufficiently interested to effect an organization amongst themselves for carrying on this work, which would thus be done without expense to the township treasury. Another plan would be for such an organization to contract with a highway commissioner to keep the roads in a given district dragged for the coming year for a certain sum of money. This latter arrangement combines the advantages of local pride and enthusiasm with the idea that payment should be made for all actual services rendered. This is suggested as perhaps the most feasible plan to adopt for an organized effort to drag the roads in a particular community.

Description of Drag.

The exact form or style of drag to be used is not the most essential part of road dragging. Most any device will prove effective which will move a small amount of earth towards the middle of the road and at the same time slick over the surface. As the whole theory and effectiveness of road dragging depends on the moving of but a small amount of earth at a time, it is important that no road drag be used which is heavy. In fact the lighter and more simple the drag the more effective it usually is.

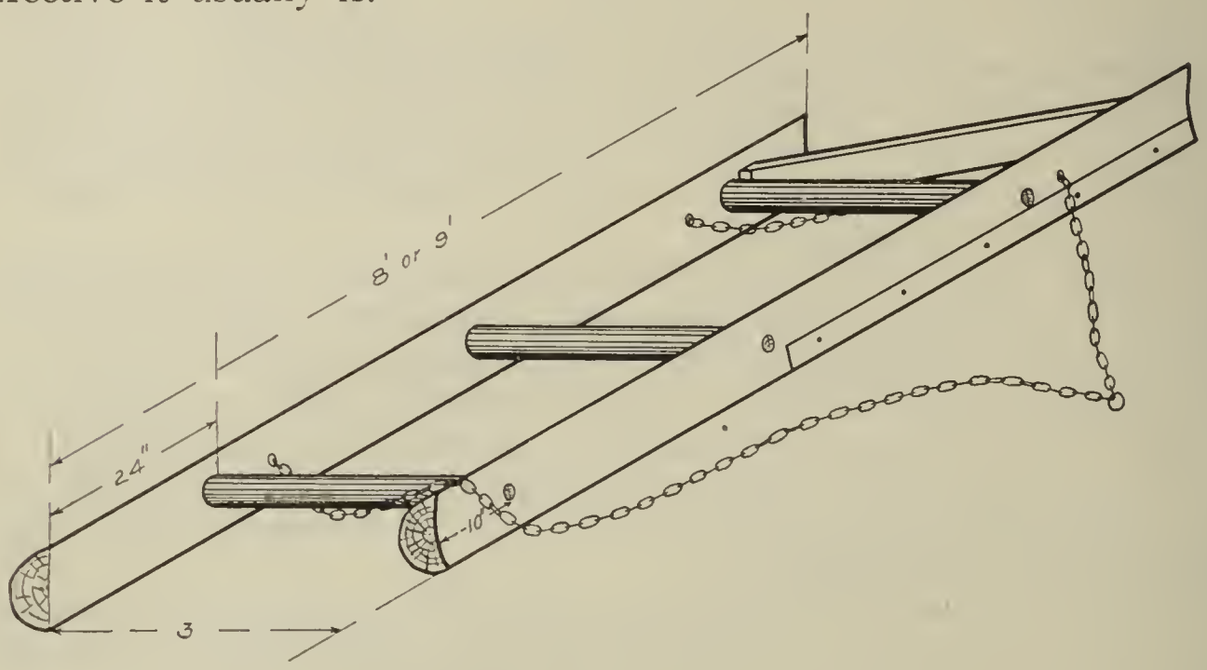


Fig. 13. Split Log Drag.

This drag is made from a ten or twelve inch log, eight or nine feet long. The cross braces are four inch sticks shaped to fit into a two inch hole. A board platform, not shown in the cut, is laid on the cross pieces for the driver to stand upon.

A simple stick of timber or piece of railroad iron has proved useful for this work. V-shaped drags have also been used, but seen to be objectionable, due to the fact of their heavy draught. Perhaps the most effective form of drag is that known as the "split-log drag," which may also be made of two stout planks in place of the split log. Oak or other heavy wood should not be used where it is possible to get a log of lighter wood.

Figure 13 shows a sketch for a split log drag which is so simple in construction that it can be made on every farm. The log should be from ten to twelve inches in diameter and about nine feet long. The holes in the front half of the log should be bored so that a slight slant forward is given to the lower part of the front face of the split log. The holes in the rear log are bored so that its flat face will be perpendicular to the sticks forming the connecting braces which should be tapered at the ends so that they will fit snugly into the holes bored into the logs. The holes should not be less than two inches in diameter. The ends of the cross sticks should be split and wedges driven so as to secure the cross braces in place. The wedges should be driven crosswise of the grain of the log or plank so as not to split it. A diagonal cross brace is placed between the logs at the leading end to stiffen the frame of the drag. The distance from the face of the back log to

the face of the front log should be about three feet. The lower front edge or toe of the drag should be protected by a strip of old wagon tire, or other piece of iron about a quarter of an inch thick and three or four inches wide and about four feet long. This strip of iron should be bolted to the front log and the heads of the bolts countersunk. The strip of iron should not be carried the entire length of the front log.

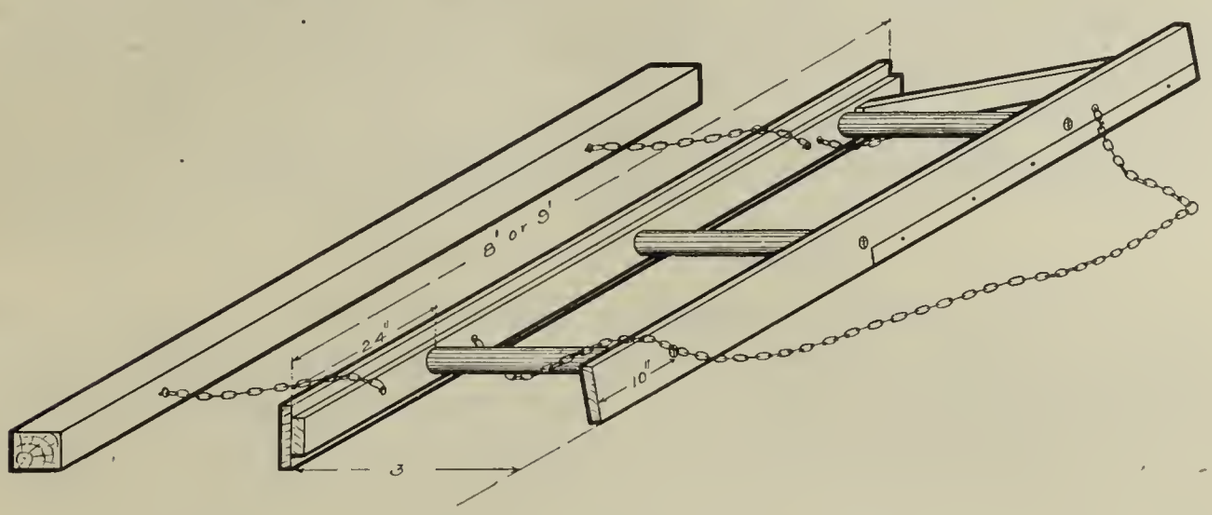


Fig. 14. Plank Drag.

This drag is made from two pieces of ten or twelve inch plank, two or three inches thick and eight or nine feet long, reinforced by a two inch by six inch strip. The cross braces are four inch sticks shaped to fit a two inch hole. A board platform, not shown in the cut, is laid on the cross pieces for the driver to stand upon. A trailing log may or may not be used. It serves to smooth the surface and distribute the mud that may pass by the drag.

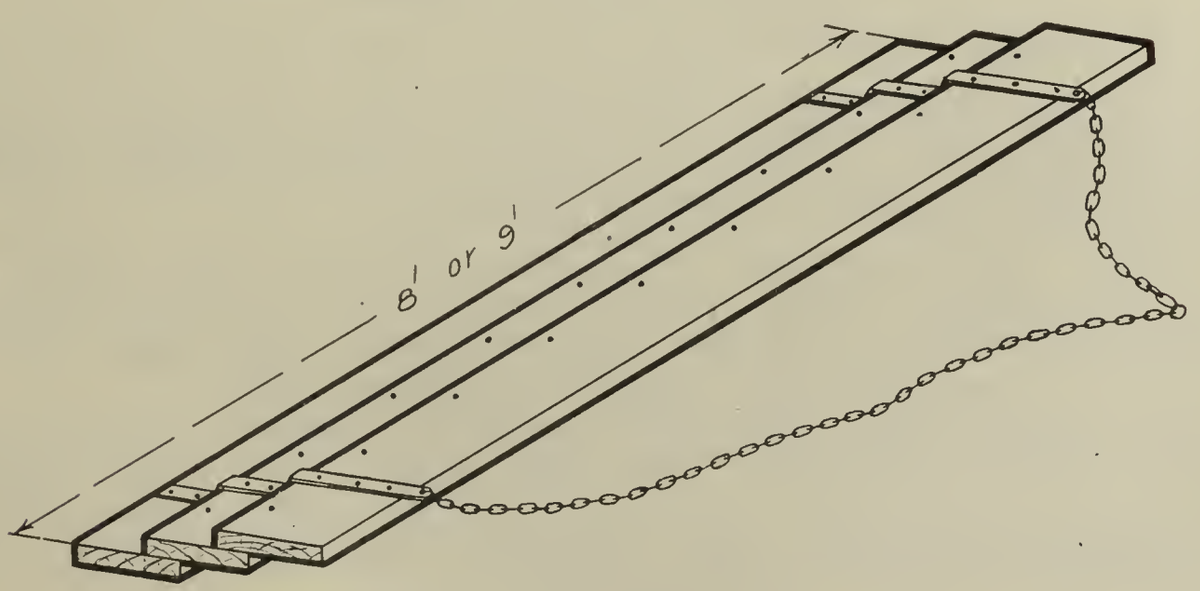


Fig. 15. Lap Plank Drag.

This form of drag has proved effective for smoothing the surface, particularly if the ruts and holes are not deep.

Chains should be provided with which to haul the drag, arranged with a short and long hitch as shown in the sketch, so that the drag will travel at an angle of about forty-five degrees with the direction of the road.

It will be noticed from the sketch that the long hitch of the chain goes over the log around one of the cross pieces rather than through a hole in the front log. This allows the earth to slide unobstructedly along the front face of the drag.

Figure 14 shows a form of drag made from planks which are reinforced on the inner side by two-inch by six-inch strips. Both forms of drag are effective and the one that can be constructed most conveniently is the one advised. Ordinarily materials for a plank drag can be more readily secured. A plank drag also has a slight advantage in that the earth will more readily slide along its face than along the rougher face of a split log. A platform of one-inch boards not shown in the sketches is laid upon the cross pieces for the driver to stand upon.

As can readily be appreciated from the cuts, the cost of the material for a drag cannot be very great—not over $3.00 or $4.00.

Object of Road Dragging.

Before giving definite instructions about operating a drag, it is well to keep in mind at the start the objects to be attained by this method of road maintenance which are to smooth the surface of the road when it is soft and muddy and to move a small amount of moist earth to the center, to maintain the crown or oval shape of the road.

The drag is not the implement to use to move large quantities of earth, nor does the maintenance of an earth road require the use of such an implement. A consideration of the theory of road dragging will help to make the use of the drag more fully understood.

Theory of Road Dragging.

If a sample of moist earth is taken from the traveled portion of a road over a gumbo, clay or black prairie soil, it will be found practically impervious to water, as may be proved by forming a roughly shaped dish of damp earth and filling it with water. It will be noticed that the dish is practically water tight.

Earth in this condition is what the clay workers call puddled. It has been worked and reworked by the carriage wheels and animals' hoofs until nearly all the traveled portion of a sticky muddy road is covered with a layer of this impervious, puddled earth.

As usually found on most of the roads, this puddled earth is full of holes and ruts, which are filled with water which cannot escape through the impervious soil. As long as the water remains the soil cannot dry out and the road is kept in a most uncomfortable if not impassable condition.

It is also a matter of observation that this puddled earth when compressed and dried becomes extremely hard. On these two facts, the imperviousness of puddled earth and its hardness when dried, rests the theory of road dragging.

The Effect of Dragging Roads.

When the road drag is properly used it spreads out the layer of impervious soil over the surface of the road, filling up the ruts and hollows until a smooth surface is secured. As a small amount of material is always to be pushed to the center, a slightly rounded effect will be given to the road, which may be increased or decreased as de-

sired by subsequent dragging. By forcing the mud into the hollows and ruts it is evident that the water must go out, which it does by running off to the side of the road. The drying out of the road is thus much facilitated and the road is made immediately firmer because the water is squeezed out.

The effect of traffic over the road tends to press down and thoroughly compact the top of the road and each thin layer of puddled earth which the drag spreads over the surface every time it is used. After the first few draggings it will be noticed that the road is becoming constantly smoother and harder so that the effect of a rain is scarcely noticeable, the water running off of the smooth hard surface which absorbs but little of it.

Instructions for Dragging.

The following points are to be borne in mind in dragging a road:

Make a light drag, which is hauled over the road at an angle so that a small amount of earth is pushed to the center of the road.

Drive the team at a walk.

Ride on the drag; do not walk.

Begin at one side of the road, returning up the opposite side.

Drag the road as soon after every rain as possible, but not when the mud is in such a condition as to stick to the drag.

Do not drag a dry road.

Drag whenever possible at all seasons of the year. If a road is dragged immediately before a cold spell it will freeze in a smooth condition.

The width of traveled way to be maintained by the drag should be from eighteen to twenty feet; first drag a little more than the width of a single wheel track, then gradually increase until desired width is obtained.

Always drag a little earth towards the center of the road until it is raised from ten to twelve inches above the edges of the traveled way.

If the drag cuts in too much, shorten the hitch.

The amount of earth that the drag will carry along can be very considerably controlled by the driver, accordingly as he stands near the cutting end or away from it.

When the roads are first dragged after a very muddy spell the wagons should drive if possible to one side until the roadway has a chance to freeze or partially dry out.

The best results from dragging are obtained only by repeated applications.

Remember that constant attention is necessary to maintain an earth road in its best condition.

The State Highway Commission has given special attention to the maintenance and dragging of earth roads, and among the questions asked the rural letter carriers were the number of miles which had been dragged, the number of drags used, and the number of times the road had been dragged. Out of a total of 33,568 miles on which reports were made by the carriers, 3,650 miles had been dragged on an average of two to three times. The total number of drags reported

was 2,585 or one drag per 1.4 miles of road dragged. In every instance the carriers reported that the results of the dragging had been beneficial.

Dragged Roads at Galva.

Perhaps the most systematic effort that has been made the past season in dragging roads was by the Galva Institute Road Improvement Association at Galva, Henry county. A report of the work of the association is given in the chater on road associations.

On Oct. 20th the roads were inspected by the State Engineer, and without question they were among the best earth roads to be found in the State. The only adverse criticism to be made is that too great a width has been maintained on some of the roads, with the result that traffic has occasionally formed two lines of travel without using the center of the road, as shown on the accompanying plate. Where the width maintained has not been over twenty-five feet, the traffic has spread more evenly and made a better road. Plate 1 shows a road that has been dragged and one in the same neighborhood that has not been so cared for. Plate 4 shows roads near Springfield, one of which has been maintained with a drag, and the other not improved. Plate 5-A shows the drag at work.

Account of Road Dragging at Salem, Ill.

Any account of road dragging in Illinois would not be complete without mention of the effective but unostentatious work done by Mr. John M. Green, of Salem, who has for the past fifteen years been using the road drag in his own neighborhood. Mr. Green gives the following description of his work:

In complying with your request for my experience in road dragging, I beg leave to state that I have had about fifteen or more years' experience in the use of the so-called split log drag. My drag is made of two planks, 2x12x8 feet in length, with a steel shoe or blade bolted on the front plank of the drag so that it extends about one-half inch below the plank. I use a common log chain attached to each end of the drag to hitch to. Regulate the proper angle for the drag to move by hitching close to the end or near the middle of the chain. Standing on the end of the drag in front or back, or placing the weight on any particular part of the drag, regulates the amount of dirt or mud to be moved to the center of the road. Two ordinary trotting horses pull the drag (with 175 pound man riding thereon) with ease.

I drag one mile of road running in front of and extending on north of Green Valley farm in direction of Salem, Illinois. The dragging is commenced in the spring as soon as the frost leaves the ground while the road is a sea of mud and water, usually go from three to four rounds with drag at this time, begin first round at ditches, carrying mud to center of road. This opens the ditches in good shape allowing all water to run off the roadbed quickly, the mud or dirt becoming solid in the shortest possible time. In two hours or less after a dragging of this kind a team can trot over said road, and the horses will not make an impression in the road deeper than the thickness of their shoes, if shod.

The after dragging consists of from one to three rounds every two to five weeks when the drag is used; it is always just after a rain, if practicable, and as the occasion may require to keep the road in good shape.

The last dragging of the season is just before freezing weather. During the winter months, should frost at any time leave the ground, and the road have a tendency to become rough from the travel, use the drag before night by going at least one round. Many times I drag the road when I have

A. Starting to Drag Early in Spring on the Clear Lake Road, Near Springfield, Sangamon County.

B. Line of Telephone Poles Inside Fence to Save Row of Trees, Near Carlinville, Macoupin County.

been driven in from the field by showers, taking advantage of the team being harnessed. As soon as rain seems to be over, hook to the drag and drag the road, and the time is not missed.

I find that in working or dragging the roads in this manner, immediately after the rains, it makes it easier for the team and the road-bed becomes harder; from working in this manner from year to year the road-bed becomes almost impervious to water. In the long dry and drouthy times, roads worked with a drag in this manner do not have one-half the dust of those worked differently. This drag with two men to ride it and two spans of horses, one hitched to each end of the drag can move almost as much dirt as a six-house road grader, in my opinion.

About one-eighth of a mile of road is worked somewhat different at times. Owing to its being clay and down grade the ditches were washed out more or less. These places that wash are partially filled with brush, then I go all around with the drag next to the ditches, throwing the dirt into them then I drag in the center of the road and carry all the dirt to the ditches. I try to do this part of the dragging after the heavy rains are over, thereby stopping the ditches from any unnecessary washing. Will say this one-eighth mile worked in this manner keeps in as good shape as any part of the road.

The past year has witnessed several pieces of road throughout the country being kept up by the use of the drag, all of which is very favorably commented upon.

Cutting Weeds.

The law prescribes that the commissioners of highways shall cause to be destroyed before coming to maturity all cockle burrs, weeds, and plants that may grow in the public highways. There is probably no amount of work that will go so far towards adding to the appearance of the road as the time spent in cutting and clearing up weeds along a roadside. Although the law prescribes that the highway commissioners shall do this, the small amount of funds in the hands of most commissioners makes it almost impossible to comply with all the requirements of the law and keep the dangerous places in the road in passable shape. But weed cutting can be so readily done by every farmer it should be a matter of pride with everyone to see that the roadside is maintained in neat and presentable condition. The good appearance of the roads in a community is as much of an asset as the condition of the roads themselves, and if but a few miles are at first kept in good shape, it will not be long before a majority of roads will be greatly improved in appearance. Note the neat appearance of the roadside in Plate 1-A, one of the roads maintained by the Galva Road Improvement Association.

Trees at the Roadside.

It is only necessary to contrast the views on Plate 4 to show the value of trees in the appearance of a road. But the trees are useful other than for aesthetic reasons. Their grateful shade makes it much more comfortable for the travelers in summer, and the moisture they hold in the road prevents the formation of dust. It has been argued that trees are injurious to the roads, but there are few instances, unless it be very low ground where the roots choke up drains, where trees are any detriment to the road; particularly if the road is to be graveled or macadamized, they are of the utmost importance, as these roads require that some moisture be held in them since they suffer far more from dry weather than wet.

The indiscriminate slaughter of beautiful shade trees along the roadside to accommodate a line of unsightly poles should be absolutely prohibited. There is plenty of room for the unsightly but useful telephone and telegraph poles without absolutely spoiling the beauty of our roadsides. It is entirely practical to run the telephone lines inside the road line so as to clear the trees. This method has been employed in a few instances, as is illustrated on Plate 5-B.

HIGHWAY BRIDGES.

Present Conditions.

The well watered area of Illinois necessitates a very large number of highway bridges over the numerous streams and creeks. The majority of these have comparatively little fall, running for the most part through broad, level valleys which make wide and shallow stream channels. Not only is a large number of bridges required, but many of them must be of considerable span. Feeding the main rivers are innumerable small creeks and ditches, many of them artificial, which have reclaimed great areas to cultivation. Wherever these creeks or ditches cross the highways, bridges are required and it is not surprising to find that nearly half of the money taxes raised for highways is spent in building and maintaining the bridges. In 1905 the amount spent for highway bridges was $1,888,724. The construction of these bridges becomes, therefore, a matter of no small consequence.

In the short time available it has been impracticable to attempt a thorough examination of many bridges, but information gathered from actual inspection and from numerous reports made by those who are familiar with the conditions points to but one conclusion—that highway bridges have cost the taxpayers far too much. Not alone have the bridges cost too much, but the type of bridge erected is often unsuited to the conditions. Many of these bridges have become dangerous to the traveling public. Old bridges are in use which are rotted and weak, and few new ones are built of sufficient strength. When the unsafe condition of many bridges is combined with a too high cost, the chance for improvement in this class of public highway work can be readily appreciated.

The cause of such deplorable conditions may be summed up as due to lack of skilled supervision. No class of construction has ever been successfully and economically carried on without such supervision, and with the almost universal lack of this essential feature the wonder is not that so many poorly constructed highway bridges are to be found, but that there are any reasonably good ones. There is probably no highway commissioner in the State who has had any training or experience which would in any way enable him to judge intelligently as to the requisite strength required in the various parts of a bridge. Furthermore, it is well understood that he does not have this knowledge. The local commissioners, therefore, must have recourse to the advice of others, and with a few exceptions this advice has been given by representatives of the various bridge companies.

These bridge companies' representatives are in business primarily to sell as much steel as possible. It is to their immediate interest to advise in every instance, first, as large a bridge as they can possibly induce the local officials to undertake, and, wherever it is at all possible, to recommend steel in place of any other material. This probably explains the great prevalence of what are known as leg or tube bridges. On Plate 6-A is shown a typical leg bridge of light, flimsy design. In place of substantial concrete abutments, such bridges are provided with steel legs or frame work; and for large bridges steel tubes are used for abutments. Moreover, the tube bridges generally require approach spans which in no way add to the effective waterway, but call for so much more steel which would be much better used if distributed in the members of the bridge proper, making a heavier and more substantial design. The use of tubes is seldom to be recommended and is the source of many bridge failures occasioned by high water. Many a bridge has been lost during a flood, which, had it been provided with properly constructed concrete abutments, would have sustained no injury whatever. The fact that a bridge is made of steel oftentimes leads the public to place undue confidence in the structure. The fact that steel is well known to be the strongest building material employed for this purpose probably accounts for the rather general opinion that if a bridge is built of steel it must necessarily be strong and durable. It is evident, as a moment's reflection will show, that the strength of a bridge depends not only upon the kind of material used, but on the amount of material and the method of using it, and the highway commissioners and public should not place confidence in a bridge because steel is used in its construction unless it is known that the bridge has been properly designed and built.

The customary method of letting a bridge is to describe merely the length and width of the bridge desired, relying entirely for detailed designs and plans on the bridge companies. The designs submitted frequently provide the minimum amount of material that is required for sustaining the proper load. Too often the details are totally insufficient for sustaining the loads coming on most highway bridges. It is not that the bridge companies object to furnishing bridges that are properly designed, but as they have no specifications on which to bid, in order to make the lowest bid and secure the contract, each one naturally will submit for consideration the very lightest form of construction which it is believed will hold up the ordinary traffic, taking a chance on the bridge sustaining some extraordinary load which, however, it is quite likely it will have to bear sooner or later. But where public safety is concerned chances must not be taken.

If the local commissioner, who by law has the responsibility of erecting highway bridges, knows that he does not possess the requisite knowledge to determine whether any chances are taken, he should consult someone who is competent to advise him. Perhaps the first step that the State Commission will have to take will be to arouse an appreciation of the responsibility that highway commissioners assume in buying bridges about which they really know nothing at all. The fact that they frequently pay so much more than the bridges are worth is by no means the most serious side of the question, although it is one which at first will probably appeal most strongly to many taxpayers.

A. Typical Leg Bridge of Light, Flimsy Design.

B. Bridge of Improper Design. A man Can Easily Shake this Bridge, which is also a Leg Bridge.

The excessive cost of bridges is due to one or all of three reasons. First, construction of too long a bridge or too much bridge; second, buying an improperly designed or style of bridge, that is, buying a type of bridge wholly unsuited to the location; third, too high a price is often paid, due to what is known as "pools" among the bidders.

Mention has already been made of how it is that too much bridge is built. The bridge company's representative can not be in the least blamed for selling as much of his goods as he can legitimately, and the mere fact that he sells a bridge that is twenty, thirty, or forty feet longer than is absolutely necessary cannot be charged up as unwarranted on his part. It is also a matter of no great wonder that the local commissioners should feel that they are doing what would be best in the long run by putting in a somewhat larger bridge than might at first to them seem required.

The high price of bridges, due to improper design or style, is a form of extravagance which is made when anything is purchased thoroughly unsatisfactory for its purpose or when a different kind could be purchased which perhaps costs no more but is more efficient, and this is true with bridges as with most other things. Highway bridges can be found which would be dear at any price, the design being such as to render them thoroughly unsuitable for their purpose. Such a bridge is shown on Plate 6-B. While this is perhaps not a frequent occurrence, yet it does occur sufficiently often to be a matter worthy of comment. It is often a fact that one type of bridge is adopted when another style could have been built which would have been far more durable. For example, instead of building short steel spans with wood floors, substantial concrete or reinforced concrete bridges should be erected. This is a type of construction which, if well designed, is more durable than any other. Thus, in the place of six or eight-foot steel bridges and wooden floors, oftentimes resting on steel legs backed up with plank to hold the earth in place, there should be substituted a concrete culvert over which the road would be graded and which would require no further attention for paint or floor renewals. The structure, when once built, is built for practically all time and is not a source of constant menace to everyone driving over it for fear a worn-out plank may have at last broken through and made a pitfall. Spans of fifty feet and less should be replaced by concrete steel construction and, in many instances, in even longer spans reinforced concrete could well be substituted for steel spans and wooden floors.

The practice of pooling among bidders at a bridge letting does not have the support of reputable bridge companies who, for the most part, would be willing to see this practice abandoned. The question naturally arises: Who is it, then, that is is instrumental in making these pools and benefits by them if it is not the bridge companies?

At nearly every bridge letting there will be found present one or two bidders, possibly more, who are not affiliated directly with any bridge company, but who nevertheless will make bids or at least arrange for the bids that are submitted .They are what are sometimes known as "scalpers" and their usual method of operation is to arrange for a minimum price at which a bid is to be submitted. This minimum price is sufficiently above the reasonable cost of the bridge in question

to insure all who participate being paid a sum which will make their attendance at the letting well worth the while, leaving perhaps to the actual constructor of the bridge but little more than a fair profit.

The above outline shows in the main the principal causes for poor bridges at extravagant prices. While these conditions present many perplexing obstacles, yet it is believed that persistent and intelligent effort towards their correction will result in great improvement, if not in a total elimination of many of the worst features.

Assistance Offered by the State Highway Commission.

The State Highway Commission undertakes, first, to furnish to the various local commissioners such skilled advice as may be necessary in the erection of their bridges. Definite specifications, plans and estimates of cost are prepared on request. Where it is decided to go ahead with the construction of the bridge, after the general design and estimated cost have been made, the commission sends to all bridge companies doing business in the State, about whom they have knowledge, such copies of plans and specifications together with detailed information of the bridge site and surroundings as will make unnecessary in most instances a personal visit of a representative of the bridge companies, thus saving what in the total is no small expense to the bridge companies and enabling them to make a bid at a minimum cost to themselves. On the other hand, this insures practical competition and will prevent almost entirely the evils resulting from what is known as "pooling." It enables all the bridge companies to bid on the same basis, which makes the letting of the bridge a businesslike affair. The local commissioners know in the first place about what the cost should be; the bridge companies know exactly what they have to furnish. The experience already gained in the short time in which the commission has been actively engaged in this work shows without question that it can be successfully undertaken by the commission in an economical manner and that the saving to the various committees will pay many times the cost. An illustration can be cited in the case of four bridges in Henry county, for which the county committee and township commissioners had made an appropriation based on the cost of similar bridges in the past. For these four bridges $30,000 had been appropriated with the expectation that their cost would be in the neighborhood of this amount. At the request of the county bridge committee the State Commission drew up plans and specifications for these bridges and attended the letting of same. The total contract price for the bridges was $16,896.

Request for Bridge Plans.

Table 5 gives in detail the location, length of span, and other general information concerning the bridges about which the advice of the State Commission has been requested by the local highway officials.

TABLE 5.

Summary of Bridge Plans and Estimates Made by the State Highway Commission.

*CORRECTED to DEC. 4, 1906.

Name of Bridge.	Location.		Kind of Bridge.	Span.	Floor to Bed of Stream.	Clear Roadway.	Contractors.		Contract Price.		Number of cubic yards.	Cost of substructure.	Total cost.	State Rock Furnished.		
	County.	Township.		Feet.	Feet.	Feet.	Superstructure.	Substructure.	Superstructure.	Substructure per cubic yard.				Quantity.	Saved per cubic yard.	Saved total.
Bollen	Henry	Geneseo	Steel concrete	140	25	16	Elkhart Bridge Co	Joliet Bridge and Iron Co.	$9,589 00	$8 50	243.7	$2,071 45	$16,896 45	243.7	$0 50	$121 85
Stimpson	do	do	do	140	25	16	do	do			406	3,451 00		406.0	50	203 00
Jeffrey	do	do	do	156		16	do	do								
Wolf	do	do	do	140	25	16	do	do			210	1,785 00		210.0	50	105 00
Smith	do	Alba	do	120	19	16	Clinton Bridge and Iron Co.	Clinton Bridge and Iron Co.	2,246 00	8 80	225	1,980 00	4,226 00	225.0	50	112 50
Haypenny	Tazewell	Delevan	Reinforced concrete	30	10	16	Burnham & Ives		995 00		90	995 00	995 00	90.0	1 44	130 00
Dutch Creek	Pike	Atlas	Steel on concrete	100	16	14	Illinois Steel Bridge Co	B. B. Horton	1,576 00	3 90	198	772 20	2,348 00			
Atkinson	Henry	Atkinson	do	140	19	16	Clinton Bridge and Iron Co.	Clinton Bridge and Iron Co.	2,600 00	8 50	191	1,623 50	4,223 50	191 0	50	95 50
Bessee	do	do	do	140	19	16	do	do	2,600 00	8 50	182	1,547 00	4,147 00	182.0	50	91 00
Bird Slough	Pike	Levee	do	80	16	16	Illinois Bridge Co	B. B. Horton	1,017 00		65	841 15	1,858 15			
Bertha Street	Fulton	Canton	Reinforced concrete	30	9	18										
Van Scyoc	Woodford	Palestine	do	12	8	16										
Oster	do	do	do	8	4	16										
Shehan	Knox	Lynn	do	15	7	16										
Beatty	Pike	Atlas-Pleasant Vale	Steel on concrete	120	20	16										
Inlet	Henry	Yorktown			10											
Wm. Miller	do	do														
Bogardus	do	do														
Adams	do	Alba														
Saltzman	do	do														
Slough	do	Loraine														
Mud Creek	do	Atkinson														
Turley	Sagamon	Williams	Reinforcing	50	10	13										
Culvert	do	Woodside	Reinforced concrete	4		59	Experimental road									
Culvert	McLean	Mt. Hope	do	5		24	do									

*Applications for bridge plans received up to Feb. 1, 1907, forty-one.

Concrete Bridges.

Figure 16 shows a standard form of reinforced concrete bridge or culvert which is suitable for spans up to fifteen or eighteen feet. This style of construction should replace in every instance the wooden culverts and short steel bridges with their high abutments, some of wood, others with steel legs backed up with plank. The expense of the concrete construction is within the means of every township. It is not necessary that all the short spans and wooden culverts be replaced at one time; two or three which are in the poorest condition should be taken for immediate construction, and each year one or two added according to the money on hand. Such a policy pursued for but a short period of years would result in permanent small bridges and eliminate the plank floor with its constant renewals and source of danger to the public.

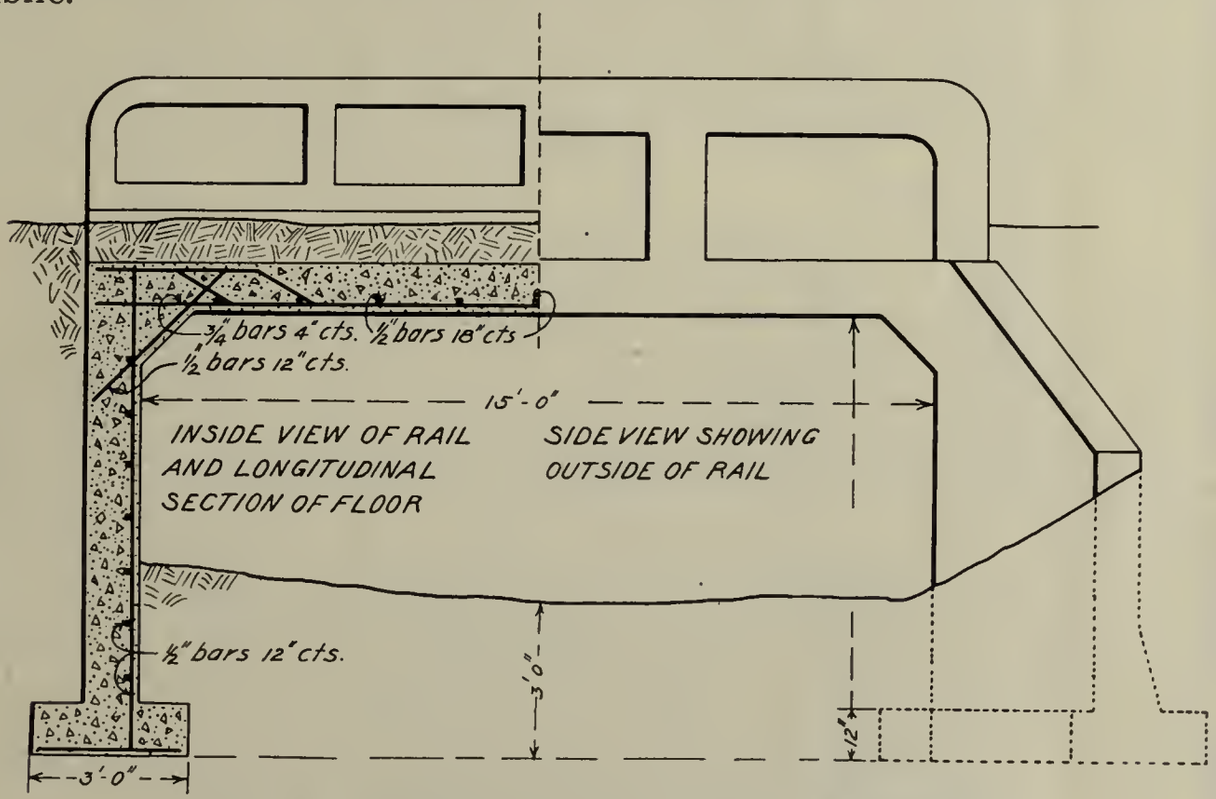
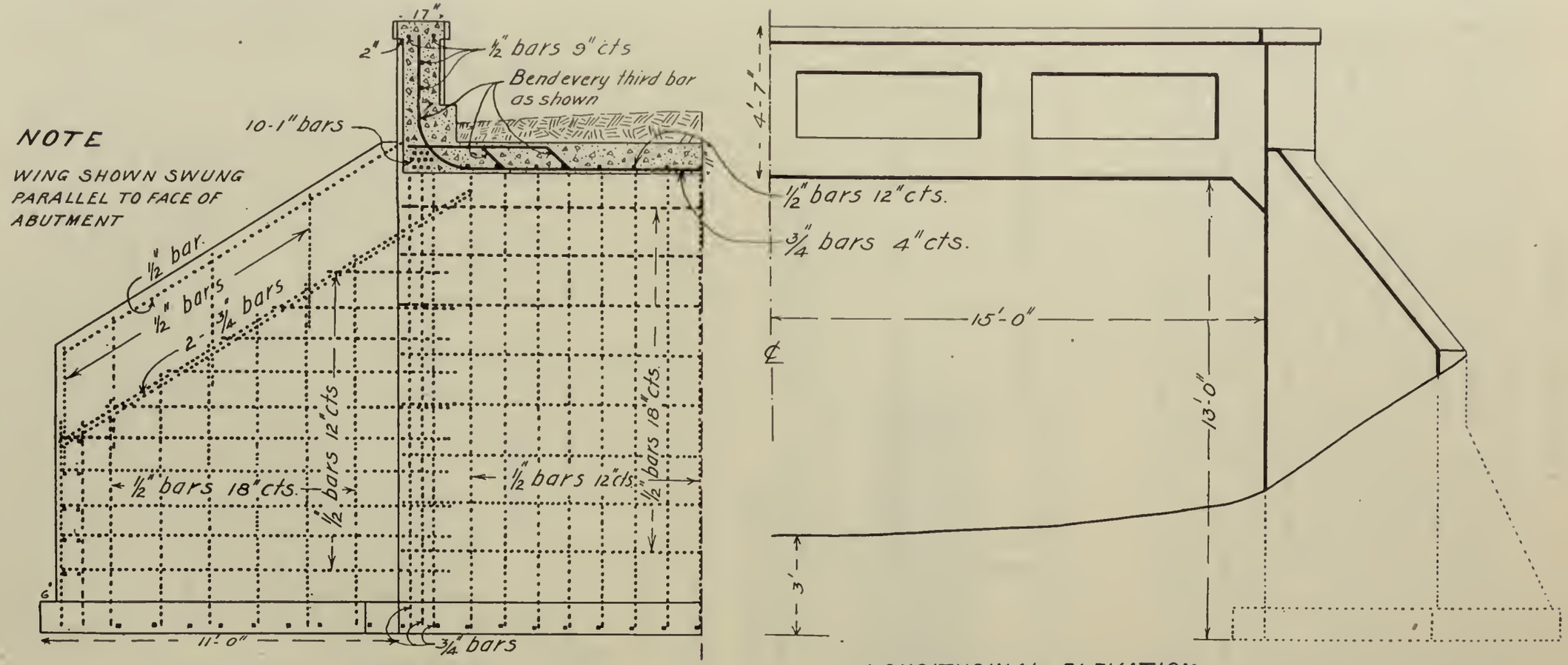


Fig. 16. Reinforced concrete bridge, 15 foot span.

Figure 17 is a sketch of an all concrete bridge, thirty-foot span. This type of construction is suitable for spans of twenty-five to fifty feet and, in fact, is practical for longer spans wherever the middle of the stream beds is such as to afford a good support for the false work and forms which are necessary to support the bridge while under construction. A bridge of this type was designed for the township commissioners at Delavan, Tazewell county. This bridge contained ninety cubic yards of concrete and 8,600 pounds of steel reinforcement. The price of this bridge was $1,125.00 if the contractor furnished everything. The State Highway Commission furnished the crushed stone to the township commissioners free of cost, which brought the price of the bridge to $995.00. If a bridge is to span a ravine, a concrete arch is a particularly appropriate form of design if the banks form a good support to the abutments carrying the thrust of the arch. Arches should be reinforced with steel in order to save the amount of concrete that would otherwise be necessary.

REINFORCED CONCRETE GIRDER BRIDGE 30 FOOT SPAN



ELEVATION OF ABUTMENT AND CROSS SECTION OF FLOOR AND GIRDERS

LONGITUDINAL ELEVATION

FIG. 17.

Steel Bridges.

The cost of concrete structures, over fifty feet long, makes steel bridges necessary in most rural communities. The standard form designed for steel truss bridges up to 150 feet in span is the ordinary Pratt truss with parallel chords. The greatest improvement that can be made in this type of bridge is the substitution of concrete floor for the usual plank floor. This form of construction adds to the dead load the bridge has to carry and thus to its weight, but where reinforced concrete is used between the floor beams, thus dispensing with the use of joists, the extra amount of steel required is not greatly increased. Thus for an eighty-foot bridge designed for plank floor, the weight of steel is 34,700 pounds, while the weight of steel in the same span bridge designed to carry the concrete floor is 36,300 pounds, including the steel in the reinforcement of the concrete. Figure 18 shows the plan of an eighty-foot bridge with reinforced concrete floor as designed for the commissioners of Levee township, Pike county. This figure is a reduced sketch of the plan furnished by the State Highway Commission with the specifications.

Bridge Specifications.

Specifications for bridge construction have been prepared which are herewith printed in full. So far as it is possible for any one set of specifications to do so, it is believed that these meet most of the conditions usually found in highway bridge work. Highway officials can obtain copies of the specifications, printed with the proper blank spaces, in case they desire to use them without asking further assistance of the State Highway Commission. This, however, they should not do except under the advice of a competent engineer who will know what changes are necessary to meet the conditions for the particular bridge that may be under consideration. Where the assistance of the State Commission is asked, all the information necessary to fill out these specifications is obtained by the State engineers and filled in properly on the blanks, which are then sent to all the bridge companies that are known to the State Highway Commission as doing business in Illinois. Each company sending in a bid fills in the places left blank for the prices on the proposal sheet. If a bidder should make any essential change in the specifications as submitted to him, his bid must be considered as irregular and cannot be received, as it is necessary that all bids shall be made upon exactly the same basis, which is one of the main objects of having printed forms for specifications.

Proposal.

instructions for bidders.

Bidders are required to give prices on all items herewith enumerated.

Bids may be sent by mail addressed as follows:

"Proposal for Highway Bridge in.....Township. .....Town Clerk, ...Illinois."

Bids will be received at the town hall in.....until.....o'clock, ..., 190...

All bids must be made on the forms prepared by the State Highway Commission. All bids otherwise submitted will be rejected as irregular.

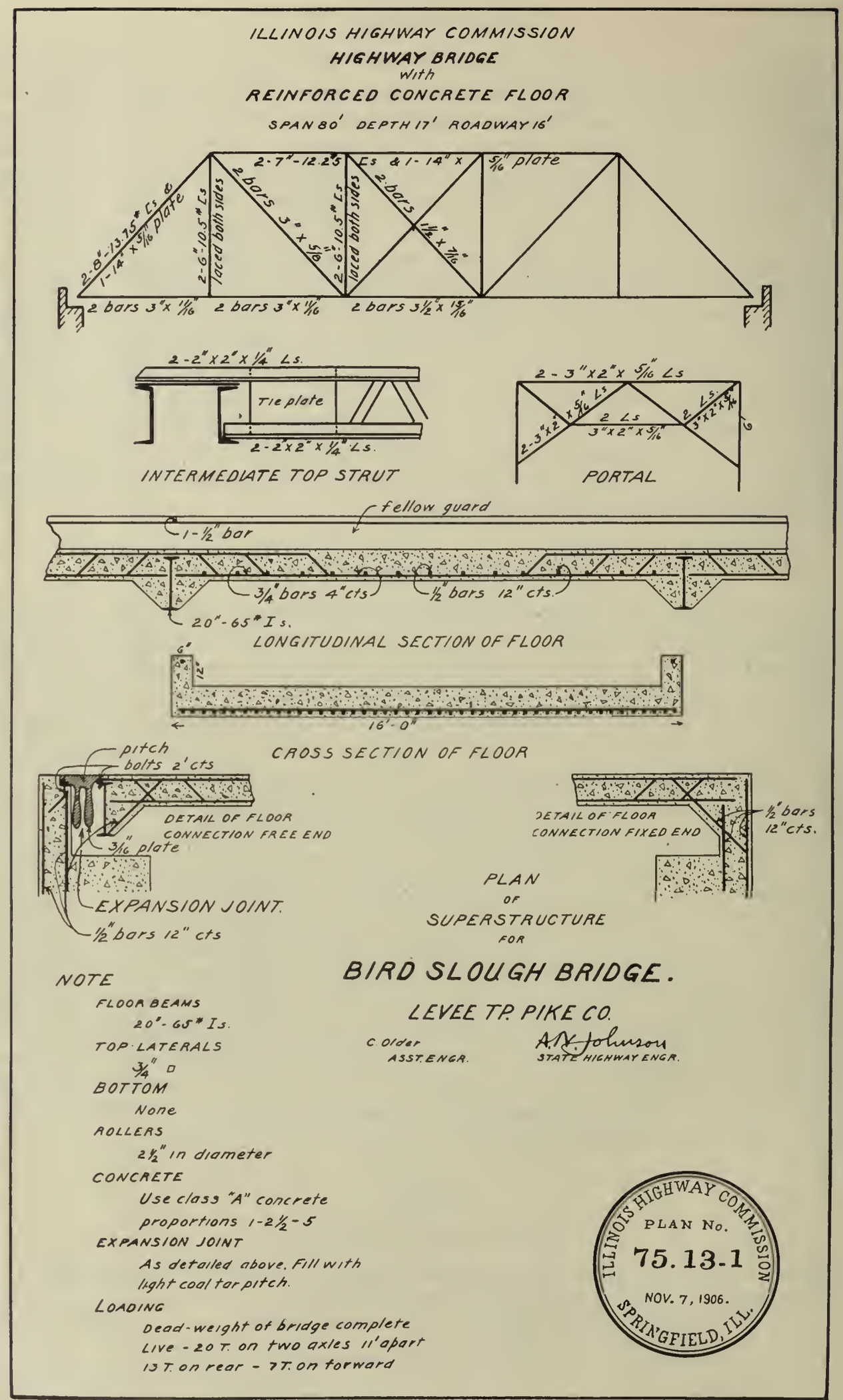


FIG 18. Plan of steel bridge with solid concrete floor.

Only sealed bids will be considered.

It is understood that the Township Commissioners reserve the right to accept or reject any proposal.

It is also understood that if this proposal is accepted and contract made, it becomes a part of said contract for which the specifications are hereto attached.

LOCATION.

The location of the proposed bridge is on the site of what is known as the ..... bridge at a point over the ..... on the highway between sections ..... and ..... in ..... Township, in ..... county, Illinois. This location is by road approximately ..... miles from the ..... railroad station at ..... and also approximately ..... miles from the ..... railroad station at .....

CERTIFIED CHECK.

This proposal must be accompanied by a certified check, payable to the Treasurer of the Township Highway Commissioners herein named, for the sum of one hundred dollars ($100.00), said check to be returned to the bidder unless, in case of acceptance of bid, bidder should fail to execute a contract and file a bond within ten days of the date of acceptance of this bid, as provided by law, in which case the check is to become the property of said commissioners and is to be considered as payment for damages, due to delay and other causes, suffered by the commissioners from neglect of the bidder to execute a contract.

PRICES.

Item A. For the construction of a reinforced concrete bridge, including construction of abutments, wing and retaining walls, arches, beams, girders, flooring and all other steel and concrete work in accordance with the specifications and as shown on the plans forming a part thereof, including furnishing of all materials, necessary forms and false work, tools, machinery, labor, excavation, removal of old structure (where such exists), and incidental work, in accordance with aforesaid plans and specifications, the sum of ..... dollars ($.....).

Item B. For the above as enumerated, except furnishing crushed rock, the same to be furnished the contractor F. O. B. cars at ....., except that all demurrage charges which accrue are to be paid by the contractor, for the sum of ..... dollars ($.....).

Item AA. For concrete masonry, as provided for on the plans in the specifications, (the contractor to furnish the stone) the following amount per cubic yard to be added to above price for each extra cubic yard, if walls of additional depth are required (not to exceed three feet more than shown on the plans), the sum of ..... dollars ($.....) per cubic yard.

Item BB. Or when rock is furnished the contractor F. O. B. as above, the sum of ..... dollars ($.....) per cubic yard.

The undersigned hereby declares that he has examined to his satisfaction the location, plans and specifications of the work for which proposal is hereby made.

PRICES FOR STEEL SUPERSTRUCTURE AND CONCRETE STRUCTURE.

Item I. For the construction of the steel superstructure complete in place in accordance with the specifications and as shown on the plans forming a part thereof, including furnishing of all material, labor, tools, machinery, false work, removal of existing structure (where such exists), and incidental work, the sum of ..... dollars ($.....).

Item II. For the construction of concrete substructure complete in place in accordance with the specifications and plans forming a part thereof including the furnishing of all material, necessary forms and false work, tools, machinery, labor, excavation and incidental work, the sum of ..... dollars ($.....) per cubic yard.

Item III. For Item II as enumerated, except furnishing crushed rock, same to be furnished the contractor F. O. B. cars at ..... except that all demurrage charges which accrue are to be paid by the contractor, the sum of ..... dollars ($.....) per cubic yard.

Item IV. For concrete masonry, as provided for on the plans and in the specifications, (the contractor to furnish the stone) the following amount for each extra cubic yard if walls of additional depth are required (not to exceed 3 feet more than show on the plans), the sum of ..... dollars ($.....) per cubic yard .

Item V. Or for Item IV when rock is furnished the contractor F. O. B. as in Item III, the sum of ..... dollars ($.....) per cubic yard.

The undersigned hereby declares that he has examined to his satisfaction the location, plans and specifications of the work for which proposal is hereby made.

Contract and Specifications.

For the building of a bridge on the site of what is known as the ..... at a point over ..... on the public highway between sections ..... and ..... in ..... township, ... county, Illinois, as provided for in the specifications annexed hereto and in the plans for the same, all of which are hereby made a part of this contract.

This Agreement, made and concluded this ..... day of ..... 190.., between ..... party of the first part, and ....., party of the second part,

Witnesseth: That for and in consideration of the payments and agreements mentioned in the proposal hereto attached to be made and performed by the party of the first part, and according to the terms expressed in bond of even date with these presents and which is a part hereof, the party of the second part agrees with said party of the first part at his own proper cost and expense to do all the work, furnish all materials and all labor necessary to do the work hereinafter described in the specifications herein contained, and in full compliance with the terms of this agreement and the requirements of the engineer under it.

In Witness Whereof, the parties hereto have set their hands on the date herein named.

Party of the First Part,
Party of the Second Part.

General Clauses.

PLANS AND SPECIFICATIONS.

The plans and specifications are hereby made a part of this contract and will be held to cover any and all work that could reasonably be inferred as needed for a complete and workmanlike job. And it is understood no advantage will be taken of discrepancies found in any drawing or specification.

The plans herein referred to are those prepared or approved by the State Highway Engineer and are stamped and numbered thus:

WORK TO BE DONE, MATERIAL AND TOOLS.

The contractor is to furnish all materials, tools, machinery and other means of construction and all labor and to do all work in connection with the construction of the proposed bridge, including removal of old structures (where such exist), all excavation necessary to complete the superstructure and substructure, and to leave the road and bridge site in a neat and presentable condition, in accordance with the specifications and plans accompanying and requirements under them of the engineer.

ENGINEER AS REFEREE.

It is agreed by both parties to this contract that the engineer shall act as referee in all questions arising under the terms of this contract between the parties thereto, and that the decision of the engineer in all such cases shall be final and binding upon both alike.

CHANGES IN PLANS.

The right is reserved to make such changes in the plans or specifications as may from time to time appear necessary or desirable, and such changes shall in no wise invalidate this contract. Should such changes be productive of increased cost to the contractor a fair and equitable sum therefor, to be agreed upon before such changed work shall have been begun, shall be added to the contract price, and in like manner deductions shall be made.

CONTRACTOR'S LIABILITY.

The contractor hereby assumes all risk and liabilities for accidents and damages that may accrue to persons or property during the prosecution of the work by reason of the negligence or carelessness of himself, his agents or his employés.

SUB-LETTING CONTRACT.

The contractor agrees to give his personal attention to this contract and not to sub-let the same, or any portion, without written consent of the engineer.

INSTRUCTIONS TO FOREMEN.

The superinendent or foreman of any particular portion of the work shall receive and obey the instructions of the engineer referring to that particular part of the work in case the contractor himself is not present.

DUTIES OF INSPECTOR.

It shall be the duty of the inspector to see that the provisions of the contract and specifications are fulfilled by the contractor; in case all the requirements of the specifications are not fulfilled to report the same immediately to the engineer. Any instructions which the inspector may give the contractor shall in no wise be construed as releasing the contractor from the proper fulfillment of the terms of this contract as determined by the engineer. The inspector will perform such other duties as the engineer may indicate.

WORK BEGUN AND COMPLETED.

The work is to begin within ..... days after the execution of this contract and to be diligently prosecuted to completion in such order as may be prescribed by the engineer.

The contractor nereby agrees to complete the work on or before ..... It is understood by both parties to this contract that if the contractor shall not complete the work by the date herein named, the commissioners may withhold from such sums as may be due the contractor under the terms of this contract an amount equal to ..... dollars ($.....) per day, this amount being that hereby agreed upon for payment in full of all damages suffered by the party of the first part because of non-completion of the work on such date.

LAWS AND ORDINANCES.

The contractor and those under him shall conduct the work in such manner as to fulfill all the requirements of State, county or municipal laws and ordinances applying to the work in hand, and he shall take such necessary precaution as will guard against losses of life or accident.

CLEANING UP.

The contractor is to leave the bridge and premises in a neat and presentable condition and to remove and clear up all rubbish and surplus material; and where it has been necessary to remove an old structure, the material from the same shall be neatly piled on the bank; it being understood that said material may be used by the contractor in the erection of the new structure.

DEFINITIONS.

Wherever the word "commissioners" is used in this contract it is understood to mean the highway commissioners of ..... acting with the committee of county supervisors, who together with the commissioners constitute the party of the first part of this contract, or their authorized representative limited by the particular duties intrusted to him.

Whenever the word "contractor" is used, it is understood to mean the person or persons who have entered into this contract as party or parties of the second part.

Whenever the word "inspector" is used, it is understood to mean the person employed to perform such duties as are herein described as duties of the inspector.

Whenever the word "engineer" is used, it is understood to mean the State Highway Engineer of the Illinois Highway Commission or his authorized representative.

PAYMENTS.

Upon certificate of the engineer that the party of the second part has completed the work herein specified, the party of the first part will pay said party of the second part all sums due under the terms of this contract.

BONDS.

The contractor shall be required to file a bond in a sum equal to double the the amount of his contract; said bond must be furnished by some reliable surety company incorporated under the laws of Illinois and must be of even date with and refer to said contract.

The law requires that said contract and bond must be executed and filed within ten days of the date of letting or awarding said contract.

Specifications for Concrete Masonry.

PLANS AND DIMENSIONS.

All concrete masonry shall be built to dimensions as shown on plans furnished or approved by the engineer and which are a part of these specifications.

The concrete shall be of the character as indicated on the plans, or as may be indicated in writing by the engineer and shall be built by the contractor in accordance with the following specifications and plans which are a part thereof.

CONCRETE.

Cement. All cement that may be used shall be of some standard Portland brand which has been in practical use on public works for not less than five years and proved satisfactory therein. No brand of cement shall be used which the engineer deems unfit for the work, nor shall any cement be used which fails to give satisfactory results according to standard methods of testing. The contractor shall provide sufficient means to protect the cement against dampness and no cement shall be used which has been thus exposed.

The contractor shall notify the engineer in writing what brand or brands he intends to use and before ordering the cement shall receive the written approval of the engineer as to the brand selected. It is understood that such approval merely covers the selection of the brand; that the cement itself may be rejected if it fails to meet the requirements herein specified.

Sand. Sand shall consist of dry, clean, sharp quartz grains and shall not contain over two per cent of clay or loam.

Stone. Stone used for concerete work shall be broken to the sizes herein specified, and shall consist of sound material. No weathered or disintegrated material shall be used.

Gravel. Gravel shall be used for concrete only when directed in writing by the engineer and shall be of such quality and mixed in such porportions as he may direct.

Classes A and B. Unless otherwise specially provided, there will be two classes of concrete known as Class A and Class B.

Class A concrete shall consist of 1 part cement, 2½ parts sand and 5 parts rock broken to pieces which will be retained on a ¾ inch screen and which will pass a 1½ inch ring.

Class B concrete shall consist of 1 part cement, 3 parts sand, 6 parts rock broken to pieces which will be retained on a three-quarters inch screen and which will pass a two and a half inch ring.

Mixing. Sand and cement shall be first mixed dry in proper proportions until mixture shows a uniform color; sufficient water shall then be added and thoroughly mixed to make a mass pasty throughout.

To the mortar thus prepared shall be added the proper proportion of broken rock which has been previously drenched with water, and the whole shall be mixed until every piece of the rock is coated with mortar. Sufficient water shall be used in mixing the concrete so that the water will readily flush to the surface with very light tamping or troweling.

Concrete shall be mixed in such quantities that a batch can be placed in the work within forty-five minutes from the time of mixing. No concrete is to be prepared from mortar which has taken an initial set and which requires retempering.

All mortar and concrete shall be mixed on a tight board or other platform approved by the engineer.

Placing. All concrete shall be carefully deposited in place, and not allowed to fall from a height exceeding three feet.

As fast as concrete is put in place, the portion next to the forms shall be troweled by using a spade or other means to bring the mortar in thorough contact with the forms.

Forms. The contractor is to provide all necessary material and means for building necessary forms for all concrete masonry.

All forms shall be so constructed as to be held rigidly in place. If at any point of the work, after the concrete has been placed, the forms show signs of bulging or sagging, that portion of the concrete shall be immediately removed and forms shall be properly supported. The amount of concrete to be removed shall be determined by the engineer, and no extra allowance shall be made to the contractor on this account.

All forms are to remain in place until in the opinion of the engineer it is safe to remove them.

It is understood that all prices for concrete masonry shall include furnishing all materials and the construction of all necessary forms and molds properly to place the concrete.

Joints. If the work is interrupted, so that the last layer of concrete will set before the next can be laid, and there are no reinforcing rods projecting, a timber 8 inches x 8 inches shall be laid the entire length of the course and shall be bedded for half its thickness in the concrete and be allowed to remain until the concrete has set. When the work of laying concrete is again resumed, the timber shall be removed, and the surface of the concrete shall be cleaned and washed with neat cement paste; and then the new concrete shall be placed immediately upon the surface thus prepared.

Finish. The forms covering what will be the exposed face of the concrete masonry shall be removed as soon as the engineer decides that it is safe to do so, and all crevices neatly filled with a 1 to 2 cement mortar. The whole surface is then to receive a wash of neat cementpaste, unless other treatment is specified.

The exposed faces are to be so finished that they will have a smooth and neat appearance.

The exposed surfaces of concrete copings, side rails, and arch rings, where so indicated on the drawings, shall be picked so as to give a roughened surface of uniform appearance; and if required by the engineer shall be washed with a paste of neat cement.

Abutments and Wing Walls. Unless otherwise specified, class B concrete shall be used in all abutments and wing walls, and shall also be used elsewhere as may be provided for on the plans or by the written directions of the engineer.

Reinforced Concrete. Reinforced arches, beams, floors, guard rails, and all concrete masonry measuring less than five inches in thickness, shall be made of class A concrete, unless otherwise shown on the drawings or directed in writing by the engineer.

Steel for Reinforced Concrete. Unless otherwise shown on the drawings all steel reinforcement in concrete shall consist of bars which shall be twisted square section bars or which shall provide for some means of rigid mechanical bond at frequent intervals.

Plain bars will be permitted only where shown on the drawings or as may be specially directed in writing by the engineer.

The steel bars shall be distributed in the concrete in the exact positions and have the net sectional area provided in the drawings.

Unless otherwise specified, all steel for reinforced concrete shall be medium steel with an elastic limit of not less than 35,000 lbs. per square inch. Steel bars shall withstand bending cold with a radius equal to twice their diameter through 180 degrees without fracture.

Before steel is placed in the concrete, it shall be free from grease, dirt and rust; and the contractor shall provide means on the work for properly cleaning the steel.

Special care shall be exercised to insure thorough contact of the concrete with every portion of the surface of the steel reinforcement.

Specifications for Steel Bridges.

LOADS.

Dead loads. To be the weight of the structure complete.

Live load on steel trusses shall be assumed as follows in designing all members and details:

For spans of 50 feet or less, a uniform load of 125 pounds per square foot of floor area, except on panel covered by concentrated load of 20 tons, which shall be considered as supported on two axles spaced 11 feet apart, the rear axle to carry 13 tons, forward axle 7 tons.

For spans of over 50 feet and under 150 feet, a uniform load of 100 pounds per square foot or floor area, except for a concentrated load as above described.

For spans of 150 feet and over, a uniform load of 85 pounds per square foot of floor area, except for a concentrated load as above described.

DETAIL OF DESIGN.

Details of design will be provided for on the plans, otherwise they shall be in accordance with the following specifications:

Floor beams. The floor beams are to be rivited or bolted between the vertical posts below the chords.

Joists. Joists are to be bolted to the floor beams, and wall channels, where provided for, by two half-inch bolts in each end.

Joists in the end panels shall extend to the outer end of the shoe.

The ends of the joists in end panels are to rest on the concrete abutments, which shall be built with pockts to receive them. The contract for the superstructure shall include filling the pockets around the ends of the joists with a 1 to 3 mortar so as to bring the tops of the joists to the proper elevation.

End plank. If provision has not been made for securing the end panel joists as above described, they shall be attached to a wall channel and against the end of the joists shall be set a first class white or burr oak plank 2½ inches thick and of a width equal to the distance from the top of the floor to the top of the masonry, and shall be three feet longer than the clear roadway of the bridge.

Plank floor. If a plank floor is required, there shall be three 4-inch by 6-inch first class white or burr oak nailing pieces bolted on the outside and middle joists by ⅝-inch bolts spaced 3 feet apart.

Flooring shall be 3-inch first class white or burr oak plank, 10 to 12 inches wide, laid heart side down; and shall be spiked to the nailing pieces by three 5-inch wire spikes to each intersection. The planks shall be sawed to uniform length, and shall be laid with their ends in a straight line.

Guard fences. The bridge shall be provided with a guard fence, consisting of two 5-inch steel channels on each side. The lower edge of the lower channel shall be 16 inches above the top of the floor, and there shall be a 12-inch space between the channels.

The guard channels shall be attached rigidly to the posts and diagonals in such a manner as to secure a straight alignment of the channel.

If the leg of the guard channel extends beyond the edge of the end post, it shall be neatly rounded off to a quadrant having a radius of 2 inches.

Concrete floor. If a solid concrete floor is called for in the plans, it shall consist of class A concrete, as herein specified.

Paint. All surfaces of the metal shall be thoroughly covered with paint of an impervious nature. The paint shall adhere thoroughly to the steel, and be free from cracks, and shall not have a drawn or shriveled appearance. The paint used shall be iron oxide and pure linseed oil or graphite and pure linseed oil.

Cooper's Specifications. Except as herein specified, or as may be specially indicated on the drawings, all members and details shall be designed in accordance with Cooper's Specifications for Highway Bridges (Edition of 1901).

ROAD MATERIALS.

Location.

Illinois does not possess so wide a variety and distribution of road making materials as is found in many other states. Nearly all the available rock is limestone, but as an offset to the scarcity of rock there are many deposits of excellent gravel, the most famous of which is the one found about twenty miles north of Cairo near Tamms, in Alexander county. Geologically, this is a chert gravel, although it has been sold and is commonly known as novaculite. Plate 7-A shows a part of the quarry from which this material is taken. The entire hill is composed of the chert, which is in layers of varying thickness and so seamed that the material, as blasted out, is in comparatively small pieces. It is extremely hard; each piece, however small, having sharp edges. This material compacts very readily and makes an excellent road. It has been used on a few miles of road in the vicinity, but its most extensive use has been in the construction of the fine highways in and about Jackson, Tennessee.

There are other deposits of chert gravel to be found in the State, also many gravel banks of glacial origin. Figure 19 shows a map of the State indicating some of the known sources of road materials. As the information on which this map was based was obtained from the township officials, it cannot be considered as complete, owing to the fact that a number of them did not answer the questions about the location of road materials in their townships. But the map will answer to show the general location of the limestone, gravels and sandstone. The latter, however, is not of much value as a road making material, though it could be used as a foundation course on which to put a better wearing surface. In general, the northern portion of the State is well provided with gravel and considerable limestone. Gravel is also abundant in the eastern portion of the State and along the valleys of the Illinois and Mississippi rivers. Limestone is found chiefly in the river valleys. With the exception of occasional deposits of gravel, a large area in the central portion of the State has no road making material.

Laboratory Tests.

The information so far gathered about the road materials of the State is at most but preliminary. In coöperation with the Illinois Geological Survey, a number of samples of gravel and limestone have

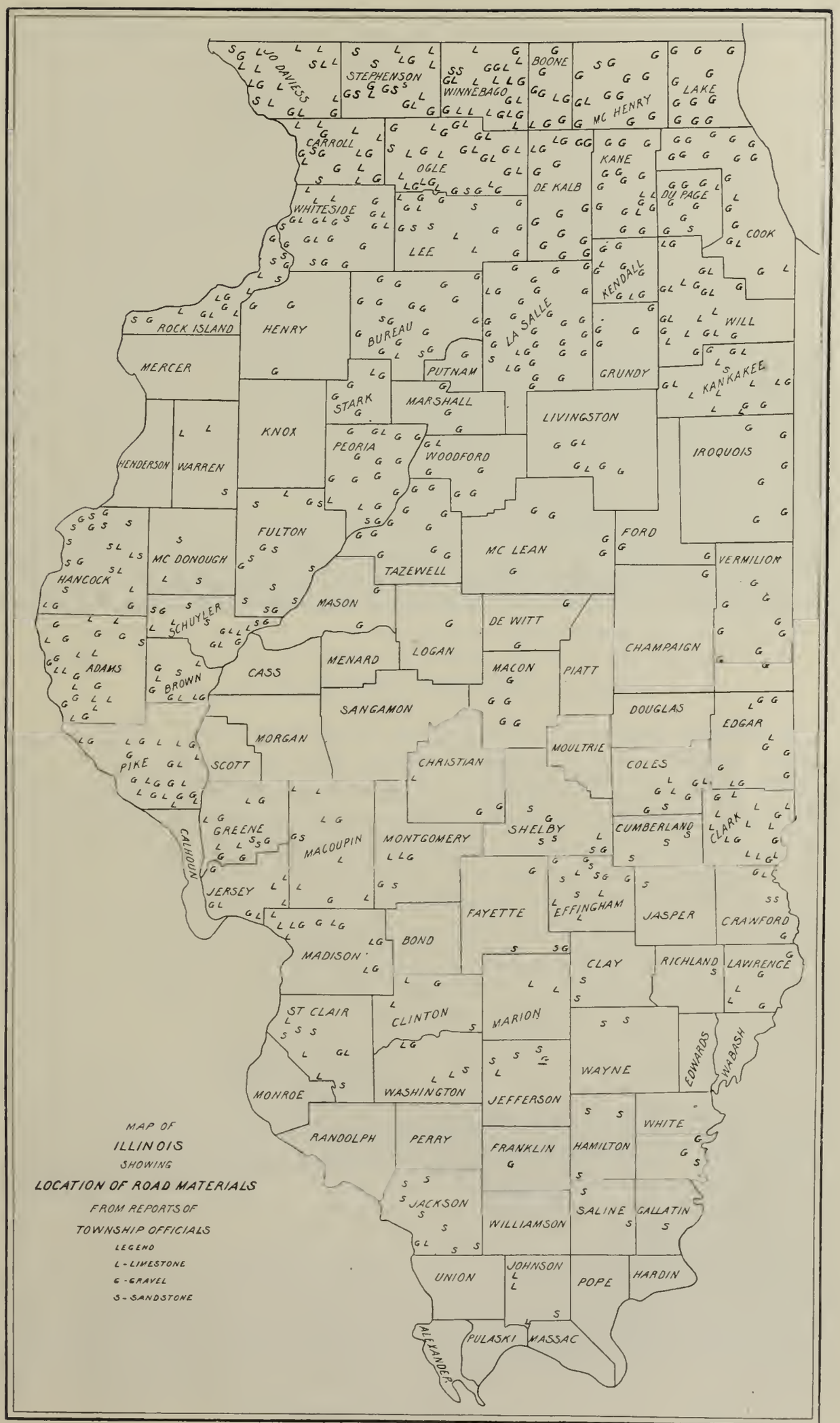

JO DAVIESS
STEPHENSON
WINNEBAGO
BOONE
MC HENRY
LAKE
CARROLL
OGLE
DE KALB
KANE
DU PAGE
COOK
WHITESIDE
LEE
KENDALL
WILL
ROCK ISLAND
HENRY
BUREAU
LA SALLE
GRUNDY
KANKAKEE
MERCER
PUTNAM
STARK
MARSHALL
LIVINGSTON
KNOX
PEORIA
WOODFORD
IROQUOIS
HENDERSON
WARREN
FULTON
MC LEAN
FORD
MC DONOUGH
TAZEWELL
VERMILION
HANCOCK
MASON
DE WITT
SCHUYLER
CHAMPAIGN
ADAMS
MENARD
LOGAN
MACON
PIATT
BROWN
CASS
SANGAMON
DOUGLAS
EDGAR
MORGAN
MOULTRIE
PIKE
SCOTT
CHRISTIAN
COLES
CALHOUN
GREENE
MACOUPIN
MONTGOMERY
SHELBY
CUMBERLAND
CLARK
JERSEY
FAYETTE
EFFINGHAM
JASPER
CRAWFORD
MADISON
BOND
CLAY
RICHLAND
LAWRENCE
ST CLAIR
CLINTON
MARION
EDWARDS
WABASH
WAYNE
MONROE
WASHINGTON
JEFFERSON
WHITE
RANDOLPH
PERRY
FRANKLIN
HAMILTON
JACKSON
WILLIAMSON
SALINE
GALLATIN
UNION
JOHNSON
POPE
HARDIN
PULASKI
MASSAC
ALEXANDER
MAP OF
ILLINOIS
SHOWING
LOCATION OF ROAD MATERIALS
FROM REPORTS OF
TOWNSHIP OFFICIALS
LEGEND
L - LIMESTONE
G - GRAVEL
S - SANDSTONE

FIG. 19.

been collected and tests have been made at the laboratory of the State Highway Commission at the University of Illinois. The results of these tests are given in Table 6, together with a number of tests on Illinois material made from time to time at the laboratory of the United States Office of Public Roads, Washington, D. C. The results of the latter tests are comparable with those made by the State Highway Commission, as the same methods are employed in both laboratories. A much more extended investigation of the road materials will be undertaken in coöperation with the State Geological Survey, to the end that a reliable and complete map of the road materials of the State can be made. Samples of the various rocks will be tested in the laboratory, where it is possible with a few hours' work to tell precisely their relative value. Complete tests on all materials used in the construction of experimental roads have been made. On some of these roads a traffic record has been taken, so that the results of the laboratory tests can be compared with the known amount of traffic on the material in question. For example, on the experimental road at Springfield there are three different materials forming the surface, all of which are subjected to the same amount of traffic, which is recorded a number of times a month throughout the year. From time to time the road will be inspected and the amount of wear on the different portions noted and compared with the laboratory results on the different materials used.

Explanation of Laboratory Tests.

The column headed "Coefficient of Wear," in Table 6, indicates the wearing quality of the different rocks; that is, the higher the coefficient the greater the resistance to wear. Hard granites and trap rocks will have a coefficient as high as 20 or 25; occasionaly over this. An excellent grade of limestone would be one having as high as 12 or 15, while a coefficient of 9 or 10 would indicate a good grade.

This coefficient of wear, however, does not necessarily indicate the actual wearing value in the road, as this depends in no small measure on the cementing value. The cementing value is supposed to represent the binding power of the small dust particles that wear off and make up the road surface. The cementing value is obtained by counting the number of blows of a kilogram hammer falling one centimeter upon a small bricquette, which is prepared from the stone dust. The number of blows producing a failure is the one recorded as the cementing value of a particular specimen.

These tests have been made in two ways: From dust which was ground dry, and also from dust which was ground when the rock was wet. For comparative purposes, the value of the wet method should be taken, as the road must necessarily become wet at some time and be ground up by the action of the traffic. Practical observation has demonstrated that any material which will give a cementing value, either wet or dry, of 25 or over will compact very readily in a road; in fact, some materials which do not give as high a value as this have proved satisfactory in the road, although this is the exception, rather than the rule.

A. A Famous Deposit of Chert or Novaculite, Near Cairo, Alexander County. Many Miles of Road have been Made from this Material at Jackson, Tennessee.

B. Inspection Patry during Construction of Experimental Road, Near Springfield, Sangamon County.

Table 6.

Physical Tests on Road Materials.

County.	Locality.	Name of Material.	Specific gravity.	Weight per cubic foot in pounds.	Pounds of water absorbed per cubic foot.	Coefficient of wear.	Cementing Value.	
							Dry.	Wet.
Alexander	Elco	Novaculite	*2.50	*152.8	*3.3	*6.80	*12	.....
Alexander	..do	..do	*2.40	*149.7	*4.13	*14.60	*4	*5
Alexander	.....	Chert	*2.60	*162.2	*0.5	*6.90	.....	.....
Alexander	Tamms	Novaculite	2.47	153.7	2.43	4.88	6	55
Bureau	Princeton	Gravel	.....	.....	.....	.....	*44	*105
Carroll	Mt. Carroll	Galena limestone	2.71	169.0	2.06	3.32	25	.....
Carroll	Savanna	Limestone	2.78	173.5	.84	3.43	57	.....
Carroll	..do	Niagara limestone	2.68	167.0	3.18	6.70	84	.....
Clark	Stumps Quarry	Limestone	2.64	164.9	2.10	6.11	53	.....
Clark	Casey	..do	2.69	167.4	.73	5.93	121	133
Coles	Charleston	..do	2.67	166.4	1.78	6.10	34	143
Coles	..do	Gravel	2.63	119.6	.....	.....	38	80
Coles	..do	Sandstone	2.39	149.0	3.21	1.00	11	142
Cook	Chicago	Dolomite	*2.70	*168.4	* .58	*9.10	*18	*30
Cook	..do	..do	*2.70	*168.4	*0.86	*6.9	*28	.....
DeWitt	Kenney	Gravel	.....	.....	.....	.....	*16	.....
JoDaviess	Menominee	Limestone	*2.70	*168.4	*1.8	*3.00	27	.....
JoDaviess	Galena	Galena limestone	2.67	166.9	2.08	4.51	16	.....
LaSalle	Ottawa	Limestone	2.74	171.0	.76	9.73	29	.....
LaSalle	Deer Park	..do	2.60	161.7	1.14	4.94	79	.....
LaSalle	Utica	..do	2.53	157.6	6.01	5.96	44	.....
LaSalle	Streator	..do	.....	.....	.....	.....	*1	*31
LaSalle	..do	Sandstone	*2.60	*159.0	*2.2	*1.90	*80	*144
Lee	Dixon	Limestone	*2.65	*165.4	*2.64	*2.91	*30	.....
Lee	..do	..do	2.65	165.4	2.69	2.91	30	.....
Lee	..do	..do	2.75	171.3	1.63	4.79	12	.....
Lee	..do	Gravel	.....	.....	.....	.....	*9	.....
Madison	Highland	..do	2.65	115.9	.....	.....	26	249
McLean	Bloomington	..do	2.64	99.38	.....	6.57	14	103
Ogle	Oregon	Chert	*2.40	*150.0	*5.66	*2.30	*15	*30
Ogle	Forreston	Gravel	.....	.....	.....	.....	*11	.....
Pulaski	Ullin	Siliceous limestone	*2.50	*155.9	*3.79	*7.2	*127	.....
Randolph	Menard	Limestone	2.59	161.8	2.45	9.35	189	227
Randolph	Chester	..do	*2.68	*168.4	*0.79	*10.42	*14	*87
Randolph	..do	Fossiliferous limestone	*2.55	*159.00	*2.93	*8.76	*9	*40

Table 6—Concluded.

County.	Locality.	Name of Material.	Specific gravity.	Weight per cubic foot in pounds.	Pounds of water absorbed per cubic foot.	Coefficient of wear.	Cementing Value.	
							Dry.	Wet.
Rock Island	Moline (Cady Quarry)	Limestone	2.69	167.6	.61	5.59	17	.....
Rock Island	..do	..do	2.66	166.0	1.56	6.95	159	.....
Rock Island	..do	..do	2.70	168.4	.42	7.88	55	.....
St. Clair	Smithton	..do	*2.70	*168.4	*0.30	*9.20	*89	.....
St. Clair	..do	..do	*2.70	*168.4	*0.17	*6.80	*88	*52
Stephenson	Freeport	Galena limestone	2.72	169.2	2.01	3.14	15	.....
Whiteside	Fulton	Niagara Limestone	2.61	162.8	3.41	3.62	26	.....
Will	Joliet	Dolomite	*2.69	*168.4	*2.58	*9.40	*8	*35
Will	..do	Limestone	2.72	169.8	2.11	7.79	52	52
Will	..do	..do	2.73	170.2	1.90	10.14	41	140
Will	..do	..do	2.63	164.5	3.54	10.67	94	96
Will	..do	..do	2.67	166.6	2.61	6.85	50	70
Will	..do	..do	2.68	167.6	2.65	10.69	30	132
Will	..do	..do	2.64	165.0	2.99	10.44	64	210

*Results marked with an asterisk (*) were made at the U. S. Office of Public Roads, Washington, D. C. The other tests were made at the laboratory of the State Highway Commission at the University of Illinois.

Weight of a Cubic Yard of Crushed Limestone.

A series of tests was conducted at the State crushing plants at Menard and Joliet to determine what should be called a cubic yard of crushed stone. Both cars and wagons were loaded in different ways and hauled different distances. The contents of each car or wagon were carefully measured and weighed, and on arrival at destination again measured, so that the variation in the density of the load due to method of loading, to size of material and to settlement, was determined. From the results of these tests, which are given in detail further on, it will be seen that the average weight of the wagon loads of limestone, including all sizes, was at the start very nearly 2,400 pounds per cubic yard, varying somewhat, according to the method of loading, and that the weight of a cubic yard in a wagon after it had been hauled a distance of one-half mile was a little over 2,600 pounds. Also, that the weight of a cubic yard of stone, as loaded in the cars, is but a few pounds over 2,400 and after settlement 2,600 pounds. As the weight of a cubic yard depends very considerably on the method of loading the car or wagon, and also as to the amount of settlement due to the length and character of the haul, the determination of what shall be the weight of a cubic yard is somewhat arbitrary. In view of the results of these tests, the State Highway Commission has adopted 2,500 pounds as the weight of a cubic yard of crushed limestone at both the Menard and Joliet crushers.

Table 7.

Weight per cubic yard of crushed limestone in carload lots and per cent of settlement in transportation. The haul in each instance was about 150 miles. See table 6 for other tests on stone from Menard and Joliet.

Shipped from.	Size in inches.	Method of loading.	Weight in pounds per cubic yard when shipped.	Per cent. of settlement.
Menard	Screenings	Fifteen foot drop	2,500	9.5
..do	..do	..do	2,509	12.5
..do	..do	..do	2,530	9.8
..do	Three	Wheel barrows	2,476	3.4
..do	..do	..do	2,320	8.2
..do	..do	Fifteen foot drop	2,528	9.5
Joliet	Screenings	Eight foot drop	2,520	0.0
..do	..do	..do	2,520	.....
..do	..do	..do	2,730	8.3
..do	..do	..do	2,610	12.5
..do	..do	..do	2,680	8.3
..do	One and one-half	..do	2,570	1.4
..do	..do	..do	2,210	13.9
..do	..do	..do	2,360	8.7
..do	..do	..do	2,300	13.6
..do	..do	..do	2,180	7.4
..do	..do	..do	2,200	9.7
..do	..do	..do	2,250	7.7
..do	Three	..do	2,520	3.8
..do	..do	..do	2,440	3.4
..do	..do	..do	2,500	5.0
..do	..do	..do	2,380	12.9
..do	..do	..do	2,300	3.7
..do	..do	..do	2,400	0.0
..do	..do	..do	2,290	9.0
..do	..do	..do	2,270	7.4
..do	..do	..do	2,275	9.2
..do	..do	..do	2,240	11.1
..do	..do	..do	2,260	10.5
..do	..do	..do	2,470	.....

Settlement of Crushed Stone in Wagons.

These tests were made to determine the settlement of crushed stone in wagon loads for different hauls. The road over which the tests were made is a macadam road, not particularly smooth, but might be considered as an average road surface. The wagon used was one with a dump bottom supported by chains, which were drawn tight as possible, so as to reduce the sag to a minimum. It will be noticed that about 50% of the settlement occurs in the first 100 feet, and 75% of the settlement in the first 200 feet. Almost all of the settlement occurs during the first half mile, as the tests showed practically no additional settlement for distances beyond.

Some of the wagons were loaded from the ground with shovels, others were loaded from bins, the stone having a fifteen-foot drop, which compacted the stone a little more than where loaded with shovels, so that there was somewhat less settlement. But at the end of a half mile the density was practically the same, whatever the method of loading. The density of the load at the beginning and at the end of the haul can be compared by the weight of a given volume of crushed stone. For convenience, the weight of a cubic yard of material at the beginning of the haul and at the end was computed from the known contents of a wagon.

Table 8.

Per cent of settlement of Crushed Limestone in wagon loads at end of different length hauls and increase in weight per cubic yard.

Size.	Method of Loading.	Length of Haul in Feet.							½ mile.	1 mile.	2 miles.	Weight Per Cubic Yard in Pounds.	
		100	200	300	400	500	600	700				At start.	At finish.
Screenings	15 ft. drop	.....	.....	.....	.....	.....	.....	.....	11.5	11.5	.....	2,518	2,840
Screenings	15 ft. drop	.....	.....	.....	.....	.....	.....	.....	12.6	12.6	.....	2,518	2,886
Screenings	15 ft. drop	7.3	8.3	8.9	9.2	9.5	10.1	10.1	11.2	.....	.....	2,450	2,770
Screenings	15 ft. drop	5.0	9.6	10.2	10.2	10.4	10.4	10.4	12.4	.....	.....	2,425	2,780
1½ inch	15 ft. drop	.....	.....	.....	.....	.....	.....	.....	11.5	11.5	11.5	2,305	2,600
1½ inch	15 ft. drop	5.3	6.2	7.1	7.7	7.9	8.0	8.3	9.2	.....	.....	2,380	2,625
1½ inch	15 ft. drop	2.6	3.7	4.9	5.3	5.3	5.3	5.4	5.4	.....	.....	2,450	2,600
1½ inch	Shovels	3.5	4.1	4.8	5.3	5.3	5.7	6.5	7.25	.....	.....	2,270	2,445
1½ inch	Shovels	.....	.....	.....	.....	.....	.....	.....	12.6	12.6	.....	2,305	2,642
3 inch	15 ft. drop	.....	.....	.....	.....	.....	.....	.....	10.1	10.1	.....	2,376	2,638
3 inch	15 ft drop	3.5	4.2	4.5	4.8	5.0	5.0	5.0	6.0	.....	.....	2,360	2,505
3 inch	15 ft. drop	0.5	2.6	2.8	4.1	4.3	4.3	4.3	4.9	.....	.....	2,470	2,595
3 inch	Shovels	.....	.....	.....	.....	.....	.....	.....	12.6	12.6	.....	2,270	2,601
3 inch	Shovels	5.0	5.6	6.5	6.5	6.8	6.8	6.8	7.1	.....	.....	2,335	2,510

Voids in Crushed Limestone.

These tests were made to determine the variation in the per cent of voids in crushed stone, due to variation in size of the material and to the method of loading. In some of the experiments a box measuring a cubic yard was used; in others a box measuring 2.8 cubic feet. No difference in the results, however, could be detected due to the size of the box. In every instance the voids were determined by weighing the amount of water added to fill the box.

Table 9.

Per cent of Voids in Crushed Limestone showing variation due to size and methods of loading.

Size.	Method of Loading.	Per cent of Voids.
3 inch	20 ft. drop	41.8
3 inch	15 ft. drop	46.8
3 inch	15 ft. drop	47.2
3 inch	Shovels	48.7
1½ inch	20 ft. drop	42.5
1½ inch	15 ft. drop	46.8
1½ inch	15 ft. drop	46.8
1½ inch	Shovels	50.5
¾ inch	20 ft. drop	39.4
¾ inch	15 ft. drop	42.7
¾ inch	15 ft. drop	41.5
¾ inch	15 ft. drop	41.8
¾ inch	Shovels	45.2
¾ inch	Shovels	44.6
⅜ inch	Shovels	41.0
⅜ inch	Shovels	40.6
⅜ inch	Shovels	41.0

CRUSHED STONE PREPARED AT THE PENITENTIARIES.

LAW PROVIDING FOR CONVICT LABOR ON HIGHWAYS.

AN ACT *authorizing and empowering the employment of convicts and prisoners in the penal and reformatory institutions of the State of Illinois in the manufacture of tile and culvert pipe for road drainage purposes, and in the manufacture of machinery, tools and appliances for the building, maintaining and repairing of the wagon roads of the State, and for preparing road building and ballasting material, upon the requisition of the State Highway Commission.*

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That the Board of Prison Industries of the State of Illinois is authorized and empowered, and it is hereby made its duty, upon the requisition of the State Highway Commission, to employ convicts and prisoners in the penal and reformatory institutions of the State in the manufacture of tile and culvert pipe, suitable for draining the wagon roads of the State, and in the preparation of road building and ballasting material, such tile, culvert pipe and road building and ballasting material to be furnished free; and in the manufacture of road machinery, tools and necessary appliances for the building, maintaining and repairing of the wagon roads of the State, such tile, culvert pipe, road building and ballasting material, road machinery, tools and appliances to be placed upon railroad cars and forwarded to proper destinations, to be used as hereinafter provided.

§2. The commissioners of highways in any township in counties under township organization, or the commissioners of highways or boards of county commissioners in counties not under township organization, may make application to the said State Highway Commission for such road building material, tile, culvert pipe, road making machinery, tools and other appliances as may be needed or required by them for the construction, improvement or repairing of the wagon roads in their respective townships or road districts, obligating themselves to use such material according to rules and regulations formulated and approved by the State Highway Commission.

§3. The State Highway Commission is hereby authorized and empowered to negotiate with railroad lines in the State of Illinois for rates of transportation on all such material and machinery, tools and appliances, and it may contract with such railroads for such transportation, to be paid in ballasting material at an agreed price.

Approved May 18, 1905.

By this Act of the Forty-fourth General Assembly, it is made the duty of the Board of Prison Industries of Illinois to prepare road building and ballasting material which shall be furnished to the highway and road district commissioners in the various counties making application to the State Highway Commission. Material so furnished shall be without charge to the local commissioners except for transportation. The law provides that the material shall be used under the

rules and regulations adopted by the State Highway Commission, and also that the said commission may negotiate with the railroad lines in the State of Illinois for rates on transportation of all such material, machinery, tools, etc. And it is also provided that the payment of rates may be made in ballast, which is to be delivered to the railroads at an agreed price.

Stone Crushers at Menard and Joliet.

Acting under the provisions of this law there has been established at the Chester Penitentiary a crushing plant with a capacity of about 300 yards a day, which has been in operation a little over a year. At the request of the State Highway Commission, the Board of Prison Industries has established a crushing plant at the Joliet Penitentiary having a capacity of 500 yards a day, which has been in constant use since the middle of August, 1906. There is also under way the installation of a third crushing plant, located at the Southern Penitentiary near Chester, with a capacity of 500 yards a day, thus making the total capacity, when in full running order, 1,300 cubic yards a day.

It is of special importance that a large storage capacity be provided, so that advantage can be taken of the winter months to prepare material for use the ensuing season. In this way a large number of cars can be loaded in a comparatively short time, facilitating both the transportation and economical handling of the material on the highway. It is of the utmost importance that the stone be received on the work in such quantities as will insure constant employment for all the teams. When only a car or two of material is received at one time, quick work cannot be done, delays occur and expenses increase.

At the crusher in operation at Menard, a storage pile was made by carrying the stone out on a trestle, which was made as high as the screens in the rock house would permit. The stone is shoveled from the pile into the cars. The new crushing plant at Menard at present under construction is located on a side hill. The plans for this plant were made by the State Highway Engineer at the request of the Board of Prison Industries, and provide for a reinforced concrete storage bin, which is so arranged that the hill side forms one side of the storage pile. The cars can be run directly below the bins and quickly loaded by opening gates provided at frequent intervals.

The crushing plant at the Joliet prison is located on level ground, which does not afford such an advantageous natural location for a storage pile. Plans are at present under consideration to provide for this, either by a trestle or an overhead cable way.

Rules and Regulations for the Distribution of Free Macadam.

The following rules and regulations were adopted provisionally and were sent to all the highway commissioners in the State. Some of these rules had to be slightly modified, as experience proved to be necessary:

1. All applications must be made on the regular forms furnished by the State Highway Commission.

2. Each application for material shall be signed by the local highway commissioners, who thereby agree that the material will be used according to the rules and regulations prescribed by the State Highway Commission as required by law.

3. The State Highway Commission will maintain a general supervision of all work where material furnished by the commisison is used.

4. If it should be found that the material supplied by the commission is not used in accordance with its plans and directions as made by the State Highway Engineer, further delivery of such material will stop immediately on the order of the State Highway Engineer and will not again be continued under the same application unless so ordered by the State Highway Commission

5. In all cases where the shipment of material has been stopped through non-compliance with the regulations of the commission, the local authorities may apply anew to continue the shipment, but this application will be taken up in turn with other applications that may be on file.

6. Before any application will be considered by the State Highway Commission the local officials making application for material must give such information concerning the proposed work on which said material is to be used as will satisfy the commission that the proposed improvement will be for the benefit of the general public.

7. The State Highway Engineer shall, before an application for stone is granted, visit the site of the proposed improvement, confer with the local highway officials, and report to the State Highway Commission his recommendation in relation to the application in question.

8. No application for less than 1,000 cubic yards of stone shall be considered, except when the local highway officials aplying for the stone send draft covering the freight charges; in which case the quantity of stone which may be secured shall be at the discretion of the State Highway Commission.

9. No township, or district (in counties not under township organization), shall receive in any twelve successive months, unless otherwise ordered by the commission, more than 2,000 cubic yards of stone, unless no other applications are on file; and this rule shall apply whether the stone be ordered by township or county officials.

10. After the date of the approval of these rules and regulations by the State Highway Commission, all applications for stone on file, or subsequently received at the office of the commission shall be numbered consecutively in the order of their receipt; and, so far as is practicable, shall be approved and filed in the same order. It is, however, understood that before any application for free material shall be approved, the local authorities making application must give ample evidence of their intention and ability to use said material in accordance with the requirements of the State Highway Commission.

11. Before stone can be shipped to any point, it will be necessray that a reasonable freight rate be secured.

Where it has been possible to arrange with the railroads to accept crushed stone in payment for freight, the material could be delivered without charge to the local commissioners; but, as would naturally be expected, such an arrangement could be made only with the initial road; that is, with the railroad in the immediate vicinity of the crusher. Such a plan was made with the Illinois Southern and the Wabash, Chester & Western from the Southern Penitentiary, and with the Chicago & Alton from the Joliet Penitentiary, so that for the most part it has been necessary to pay the freight in cash.

Freight Rates on Free Macadam.

After a number of conferences with the heads of the main railroad systems in Illinois relative to granting special rates on crushed stone which should be delivered by the State Highway Commission free to the local road commissioners, it was decided to address a circular letter to all the railroads in the State. In reply to this circular, at a special meeting of the representatives of the initial Illinois railroads to consider the subject of rates on road making material between points in the State of Illinois, held at the Central Freight Association Committee's

rooms in Chicago, Tuesday, June 12, 1906, the following rates were adopted by the eighteen railroads represented and have also been accepted by most of the other roads in the State. It is probable that as the work goes on and becomes more systematized lower rates can be arranged for, especially on the initial lines. The general rate granted by the railroads provides for ½ cent per ton per mile for each road participating in a particular haul, minimum of 25 cents per net ton for each road. The Chicago & Alton Railway Company has granted a rate of 3 mills per net ton, minimum of 25 cents a ton, to points along its line.

The Illinois Central road has granted the following rates on crushed stone to points on its line:

For distances of—	Rates in cents per net ton.	For distances of—	Rates in cents per net ton.
25 miles	25	125 miles	45
50 miles	30	150 miles	50
75 miles	35	200 miles	60
100 miles	40	250 miles	75

The following rates on road machinery were also granted the commission by most of the Illinois roads:

$ 8.00 per car	50 miles or less
12.00 per car	100 miles or less
15.00 per car	150 miles or less
20.00 per car	200 miles or less

These rates are to apply for a single road haul and also as joint rates, but in the latter case the minimum charge for each road participating in the shipment will be $5.00 per car, and the gross rates are to be thus ascertained.

The Illinois Central road has granted the following rates on road machinery to points on its line:

For distances of—	Rate per car.	For distances of—	Rate per car.
25 miles	$10 00	125 miles	$20 00
50 miles	12 50	150 miles	20 00
75 miles	15 00	200 miles	25 00
100 miles	17 50	250 miles	25 00

The question was raised by a number of railroads as to their liability to grant other shippers the same rates as those granted the State Highway Commission. This question was referred to the Attorney General, who rendered the following opinion:

* * * * * * * "The preparation and transportation of such material and machinery, under the provisions of said Act, does not enter into or affect the general commerce carried on within the State, and is for the public benefit of all the people of the State, and it is therefore my opinion that the State Highway Commission has authority to negotiate with railroad lines in the State of Illinois for rates of transportation on all such material and

FIG. 20. Showing localities making application for free macadam.

machinery, and that any rates so made by any railroad company pursuant to such negotiations with said commission would apply strictly to the transportation of such material and machinery, and that said railroad companies would not be compelled to make the same rates to other shippers."

Applications for Free Macadam.

As soon as the terms on which crushed stone could be furnished became known, many applications were filed with the State Highway Commission; in fact, a great many more than it was possible to fill. As would be naturally expected in a new undertaking of this sort, there would necessarily be a great many delays in the beginning. The Joliet crusher could not be put in operation before the middle of the summer, so that localities in that vicinity could not be supplied before then. Moreover, before material could be shipped, it was necessary to arrange for special rates, and necessarily negotiations with as many railroads as there are in Illinois required much time. The wide interest in this feature of the work is shown by the following table of applications for crushed rock. The geographical position of the various localities will be better understood from Figure 20. There have been in all 127 applications filed from 127 townships in fifty-seven counties, totaling 276,365 cubic yards.

Table 10.

Application Filed with the State Highway Commission for Crushed Rock.

County.	Township.	Amount applied for. Cubic yards.
Alexander	Road district 5	1,000
Bond	Burgess	1,000
Bond	Central	3,000
Bureau	LaMoille	2,000
Bureau	Milo	2,000
Bureau	Neponset	60
Bureau	Princeton	1,000
Bureau	Walnut	2,000
Christian	Prairieton	2,000
Clark	Casey	2,000
Clark	Martinsville	2,000
Clark	Westfield	2,000
Clay	Clay City	9,000
Clay	*Xenia Village	500
Clinton	Brookside	1,000
Clinton	Germantown	1,000
Clinton	Wheatfield	60
Cook	Orland	2,000
Cook	Wheeling	2,000
Crawford	LaMotte	2,000
Crawford	Robinson	2,000
DeKalb	DeKalb	2,000
DeKalb	Genoa	2,000
DeKalb	Shabbona	1,000
Edgar	Kansas	2,000
Edgar	Paris	2,000
Edgar	Ross	2,000
Effingham	Douglas	2,000
Effingham	Teutopolis	2,000
Fayette	Lone Grove	1,000
Franklin	Benton	3,000
Franklin	Franklin	3,000

TABLE 10—*Continued.*

County.	Township.	Amount applied for. Cubic yards.
Franklin	Ewing	3,000
Fulton	Canton	2,000
Greene	Rockbridge	3,000
Grundy	Braceville	2,000
Grundy	Felix	2,000
Grundy	Goose Lake	1,500
Grundy	Greenfield	2,000
Grundy	Highland	2,000
Grundy	Mazon	3,000
Grundy	Garfield	2,000
Hancock	Carthage	2,000
Henderson	Road district 5	1,000
Henry	Alba	225
Henry	Atkinson	145
Henry	Geneseo	800
Iroquois	Milford	2,000
Iroquois	Stockland	2,000
Jackson	Fountain Bluff	150
Jackson	Grand Tower	12,000
Jackson	Somerset	300
Jackson	Vergennes	1,000
Jasper	*Newton City	1,000
Jefferson	*Mt. Vernon	3,000
Jersey	Jersey	2,800
Johnson	Vienna	1,500
Kane	Blackberry	500
Kane	Campton	2,000
Kankakee	Rockville	1,000
Kankakee	St. Anne	2,000
Kankakee	Salina	3,000
Kankakee	Sumner	1,000
Kendall	Nasusay	2,000
Kendall	Seward	2,000
Lake	Waukegan	2,000
LaSalle	Earl	2,000
Lee	*Sublette Village	2,000
Lee	Subette	2,000
Lee	Willow Creek	2,000
Livingston	*Dwight	2,000
McLean	Anchor	2,000
McLean	Arrowsmith	2,000
McLean	Bloomington	200
McLean	Mt. Hope	2,000
Macoupin	Nilwood	1,200
Madison	Leef	2,000
Madison	Pin Oak	2,000
Madison	Saline	1,000
Madison	Venice	1,000
Marion	Odin	1,200
Marion	Salem	9,000
Marion	Sandoval	3,000
Monroe	Road district 9	1,200
Monroe	Road district 8	1,350
Monroe	Road district 10	90
Morgan		2,000
Peoria	Limestone	1,500
Perry		3,000
Perry	Road district 44	1,500
Piatt	Cerro Gordo	2,000
Randolph	Road district 13	425
Randolph	Road district 12	30
Randolph	Road district 6	3,000
Randolph	Road district 5	3,000
Randolph	Road district 2	3,000
Rock Island	South Moline	1,000
Rock Island	South Rock Island	5,000
St. Clair	Lenzburg	1,000
St. Clair	New Athens	30
St. Clair	Smithton	60
St. Clair	Sugar Loaf	9,000
St. Clair	Sugar Loaf	6,000
St. Clair	Sugar Loaf	3,000
Sangamon	Williams	60

TABLE 10.—*Concluded.*

County.	Township.	Amount applied for. Cubic yards.
Sangamon	Woodside	2,000
Shelby	Sigel	2,000
Stark	Osceola	2,000
Tazewell	Delavan	130
Tazewell	Washington	2,000
Union	Road district 9	1,000
Vermilion	Grant	2,000
Warren	Monmouth	2,000
Washington	Hoyleton	1,000
Washington	Lively Grove	350
Washington	Nashville	2,000
Wayne	Grover	2,000
Whiteside	Portland	1,500
Will	Crete	2,000
Will	Florence	2,000
Will	Frankfort	2,000
Will	Jackson	1,000
Will	Joliet	2,000
Will	Lockport	2,000
Will	Manhattan	10,000
Will	New Lenox	5,000
Williamson		15,000
57 counties	127 townships	276,365

*Some incorporated cities and villages made application, but in the opinion of the Attorney General, the State Highway Commission could not legally grant these requests.

SHIPMENTS OF FREE MACADAM.

As soon as it was definitely known what the rates on crushed stone would be and the conditions under which it would be shipped, the various boards of commissioners making application for material were advised accordingly and shipments were made. In some instances the commissioners decided they could not use the material for the present, under the conditions imposed, but the majority of them were ready to use it if it could be shipped at a convenient time. So far as possible, the stone was shipped to those communities which were best situated to take the material at the time it could be offered to them and which seemed in position to make the best use of it. In each case the road on which the material was to be used was inspected and the local commissioners advised as to how it should be applied. Instructions were not always carried out as carefully as could be desired, and the best results have not been obtained in every instance. The best results have been obtained where material has been used for experimental roads built under the immediate supervision of the State Highway Commission.

The following table gives a list of the townships and the amount of material shipped in each case. Many townships are ready to receive material next season, as soon as it is possible to use it to advantage.

Table 11.

Shipments to Townships and Road Districts of Crushed Rock, Requisitioned by the State Highway Commission from the State Penitentiaries.

County.	Township.	Cubic yards.	Shipped from.
Bond	Central	4,000	Menard
Cook	Orland	2,000	Joliet
DeKalb	DeKalb	5,000	..do
Fayette	Lone Grove	35*	Menard
Franklin	Benton	1,445	Menard
Henry	Alba	250*	Joliet
Henry	Atkinson	220*	Joliet
Henry	Geneseo	300*	..do
Kendall	Seward	2,000	..do
McLean	Mt. Hope	4,500	Joliet
Marion	Salem	2,200	Menard
Monroe	Road District No. 9	1,200	Menard
Randolph	Road District No. 6	1,100	..do
Randolph	Road District No. 5	100†	..do
Randolph	Road District No. 13	425†	Menard
St. Clair	Sugar Loaf	3,000	Menard
Sangamon	Woodside	1,500	Menard
Sangamon	Woodside	2,500	Joliet
Tazewell	Delavan	130*	Joliet
Union	Road District No. 9	1,000	Menard
Washington	Nashville	2,000	..do
Will	Manhattan	3,000	Joliet
Will	New Lenox	2,000	..do
		39,905	

*For bridge work.

†Requisitioned prior to January, 1906.

EXPERIMENTAL ROADS.

Experimental road construction has been undertaken by the State Highway Commission to show, by a practical object lesson, exactly what improved methods could accomplish and what practical benefit a community would gain from their use. There had arisen in the minds of many a serious doubt as to the possibility of constructing and maintaining in proper condition a macadam road over many of the soils to be found, especially in the central portion of the State. There were many communities who were ready to build macadam roads if they could feel reasonably sure that they could be economically constructed to withstand the local conditions. It seemed, therefore, particularly appropriate for the State Highway Commission to make some experiments under these conditions to demonstrate the practicability of this form of construction.

A complete program of experimental work would include a trial of all methods of construction which might promise good results, especially to try those methods which might be new for the conditions presented, and also to try, perhaps, some entirely new methods. To some extent this program has already been undertaken, but there remain very many important experiments which should be given a trial, particularly in the waterproofing of the surface of an earth road in some simple and inexpensive manner. This is to a degree accomplished by the road drag, which makes use of the semi-waterproof condition of the puddled earth found in most of the clay and gumbo roads. While the drag is undoubtedly the best known means of maintaining the majority of earth roads, it is, however, not entirely satisfactory on roads with the largest amount of traffic. It is believed that experiments should be made in the use of tar and oil—particularly in the use of tar, which already has been tried to a very small extent on one of the roads built this last year; and, if the results prove promising, will be more extensively tried another season.

Petitions for Experimental Roads.

A comparatively large number of applications for experimental roads was received and taken under consideration, but owing to the shortness of time in which to prepare for their construction and to the limited means at the command of the commission, it was impossible to construct in all but five of the roads petitioned for. It is believed that it will be possible another season to construct many more than

has been done in 1906, as much of the time necessarily spent in preliminary arrangements will be saved. Table 12 gives a list of the townships making application for experimental roads arranged alphabetically, according to the counties.

TABLE 12.

Townships Petitioning for Experimental Roads.

County.	Township.	Date.
Bond	Central	May 14, 1906
Bureau	Milo	Feb. 27, 1906
Clinton	Brookside	May 28, 1906
Cook	Orland	Aug. 24, 1906
DeKalb	DeKalb	Jan. 24, 1906
DeKalb	DeKalb	Nov. 23, 1906
Effingham	Teutopolis	Sept. 22, 1906
Effingham	Douglas	Sept. 5, 1906
Fulton	Union	April 2, 1906
Jersey	Jersey	Aug. 22, 1905
Livingston	Reading	May 21, 1906
Logan	East Lincoln	Jan. 20, 1906
Logan	West Lincoln	Jan. 30, 1906
Marion	Foster	Dec. 5, 1905
McLean	Normal	April 12, 1906
Moultrie	East Nelson	Dec. 14, 1905
Moultrie	Sullivan	Dec. 14, 1905
Piatt	Cerro Gordo	April 11, 1906
Rock Island	South Rock Island	May 16, 1906
Sangamon	Woodside	May 11, 1906
St. Clair	Sugar Loaf	Sept. 14, 1906
Stark	Osceola	April 4, 1906
Will	Lockport	June 1, 1906
Will	New Lenox	Sept. 6, 1906
Will	Manhattan	July 7, 1906

It will be seen that the requests came from twenty-four townships in nineteen counties. In most instances the money for the work was to be provided by private subscription, the township officials making small appropriations and agreeing to do some part of the work. Some communities were ready with a greater amount of money than others, which guided to a considerable extent the selection of the places where the experiments have been undertaken. The stone for roads was crushed by the State at the penitentiaries, so that the actual cost to the State Highway Commission for these roads was reduced to a minimum. On the Springfield road a small amount of chert gravel from Kinderhook, which is available locally for roads, was used, as was also some burned shale from a nearby mine dump. Experimental roads were constructed as follows:

At Salem, in Marion county; Springfield, in Sangamon county; McLean, in McLean county; Greenville, in Bond county, and DeKalb, in DeKalb county.

The cost of the experimental roads built this past season has been borne in a large part by the local communities who petitioned the State Highway Commission to make the experiment and provided either in money or labor for the construction of the road.

METHODS OF CONSTRUCTION.

The method of constructing experimental macadam roads was practically the same in every instance. The limestone is too soft for

macadam roads, although good when compared with other limestones found within the State. The usual method placing the small size stone in the top layer with the larger stone underneath was reversed, on account of the softness of the stone; that is, the one and one-half inch material was placed in the bottom course, while the three-inch material was placed on the top of the road. In this way it was possible to use the entire product of the crusher and at the same time avoid the small pieces of rock in the surface of the road which would be easily ground up owing to the soft nature of the material, whereas the larger pieces of rock are stronger and offer more resistance to the crushing effect of the traffic. It is found that material handled in this way will make a road two or three times more durable than if the material were used in the manner employed when hard trap rocks or granite are used in the construction of a road.

As fast as the road bed was graded and shaped, narrow trenches were cut through the earth shoulders about every fifty feet on either side. These side trenches or laterals were filled with broken stone to the depth of the first course of stone in the road. The object of the laterals is to drain the road bed, particularly during the construction before the broken stone has been rolled and made waterproof with the binder course. If this precaution is not taken, rain will readily go through the porous stone covering and will settle in the road bed, when no further work can be done until it is dried out, which will often take a number of days where a sticky clay soil is encountered.

In each instance the road bed was carefully shaped to the proper cross section and thoroughly rolled. On it was then spread the first layer of stone, usually six inches thick, measured loose. The material was evenly distributed by the aid of blocks, which were set one at each side and one in the middle, so that an even layer of stone could be spread. This first layer was thoroughly rolled, and the second layer was then spread the same thickness and also thoroughly rolled. Screenings were applied and were watered and rolled until the mud thus formed would flush to the surface, which showed that the surface of the road was practically water tight. The shoulders were shaped to conform with the crown of the road, which was an inch to the foot.

The greatest difficulty to be encountered in isolated stretches of macadam road in sticky, muddy country is to prevent the road from picking up, as will surely happen, especially in the first winter, unless some special means of protection is taken. On the experimental road at Springfield one end of the road was covered for a short distance with tar, which has proved effective so far in keeping the road surface intact, whereas at the other end of the road the mud has loosened for a short distance some of the material, making it necessary to keep careful watch of the road and to supply some loose material for the mud to take hold of, rather than to allow it to pick out the road itself.

After a road has had a season's traffic and become thoroughly set, there does not seem to be the same difficulty as is experienced with new stretches of road. On the road at Greenville it was necessary to place some ties, making a sort of corduroy, on which the mud could be shaken from the wheels. This road was especialy exposed, on account

A. Experimental Road, Near Springfield at Old Culvert before Improvement.

B. Experimental Road, Near Springfiled, at Culvert, during Construction. Shale Base in the Foreground.

of the fact that the road was not finished until muddy weather had set in. The best method of protecting a newly made road will be carefully studied, so that trouble from this source may in the future be reduced to a minimum.

Cost Data.

A daily record was kept of all work done in the construction of these roads, so that the exact amount of labor is known. The amount of material used was also recorded. Inasmuch as the material in these roads was furnished from the penitentiaries, its cost, if stated, would have to be on some arbitrary value which might or might not apply to different localities. The detailed cost items are shown for the labor only, but with a given amount of material and a given price, it is evident that estimates can be made of the total cost of the work when the amount of labor necessary is known.

In giving the total cost of macadamizing a road, the cost of culverts and bridges has been omitted. Culverts and bridges are necessary, whether the road is surfaced or not, and owing to the fact that one stretch of road might have more culverts than another, a fair comparison of the cost of different sections could not be made if these items were included. If work is to be done by contract, the estimate should include a fair profit above the actual labor cost as given.

The difference in the labor cost of the experimental roads which were built in the past season is due chiefly to the character of the labor available. On some of the work all of the men seemed to take an interest and be anxious to make it a success. In other instances the apparent desire seemed to be to do the least amount of work for which a day's pay would be allowed. Therefore, in estimating on other work, if the character of the labor is known to be good, it would be safe to estimate on the lowest cost; but if only poor labor is available, the highest cost should be taken.

Salem Road, Salem Township, Marion County.

The road selected for experimental work at Salem is just outside the limits of the city in Salem township. All the labor cost of this experimental road was borne by the city of Salem and the Salem township commissioners.

The highway commissioners first applied for broken stone, which was furnished and a piece of road built by them. Owing to the lack of facilities, the road thus laid was poorly made. The people at Salem were anxious to have this work done in a proper manner, and later a request was made to the State Highway Commission to undertake the construction of a piece of the road. This was accordingly done, and about 2,200 feet were completed with the aid of a steam roller and modern methods of construction.

The width of the macadam is about fourteen feet and the depth is eight inches. Part of the work was resurfacing the road laid by the local commissioners, at the end of which was about 600 feet of newly constructed road. The exact cost cannot be ascertained, owing to lack of records on the work done prior to that under charge of the

State Highway Commission. The estimated cost of this work per mile, including grading and shaping the subgrade, hauling the stone a distance of about a mile and a quarter, spreading and rolling, is about $2,500.00. The material was furnished free by the State from the State rock crusher at the Southern Illinois penitentiary at Menard. The freight on the stone over the Illinois Southern Railroad was paid in the ballast.

The contrast between the portion of road built with the steam roller and that upon which the roller was not used furnishes a most striking illustration of the importance of proper equipment and technical experience in macadam road construction.

The improved piece of road is attracting a great deal of attention locally, and the travel over other routes in the vicinity is almost entirely diverted to the new road, in spite of the fact that the distance is thus increased.

A view of this completed road is seen on Plate 10-A.

Springfield-Pawnee Road, Woodside Township, Sangamon County.

This road, which extends south from the city limits of Springfield, is an extension of South Sixth street, and was improved for the distance of a mile. The Business Men's Association agreed if this particular piece of road was selected for the construction of an experimental road, to contribute $2,000.00 towards the cost, provided the macadam on the first half mile was made not less than sixteen feet wide. Surveys were made, grades established and the work planned accordingly.

The first half mile of this road is over black gumbo soil, which is extremely sticky in wet weather. This portion of the road is very nearly level, the maximum grade that could be secured being but 0.08 of a foot per 100 feet. The south end of the road rises until about nine feet higher than the lowest point, with a uniform grade of 0.35 feet per 100 feet. The soil on the last half or one-third of a mile is considerably less sticky than that encountered in the first half.

At a point 1,700 feet from the north end a small creek is crossed, which is the lowest portion of the road. The old culvert at this point was made of brick and was in very poor condition. Many of the bricks were displaced and the sides of the culvert were bulged out of shape, making it necessary to replace it. The new structure is built of concrete, with a reinforced concrete top. The culvert was extended the full width of the road, the extra length being paid for by private subscriptions.

In the center of the road, and three and one-half feet below the top of the finished surface, a six-inch tile drain was laid for a total distance of 4,000 feet, draining into the culvert. After the tile were laid the trench was carefully back filled with burned shale. The contract price for this under drain was $1.75 per rod.

Four different materials were used in the construction of this road: Limestone from the State Penitentiary at Joliet, limestone from the State Penitentiary at Menard, burned shale from a coal mine dump

A. Experimental Road Near Springfield. View of Finished Road at South End on December 5, 1906.

B. Earth Road Leading West from South End of Experimental Road Near Springfield, December 5, 1906.

about 1,000 feet from the road, and chert gravel from Kinderhook, situated about sixty miles west on the Wabash Railroad. All the stone and gravel were shipped by rail and delivered at a siding about 800 feet from the north end of the road, the average haul being little over half a mile. The north end of the road as far as the culvert, a distance of about 1,700 feet, was constructed with a shale foundation six inches thick, over which was placed a limestone top, also six inches thick. For the first 1,000 feet on the north end shale shoulders were constructed on either side seven feet wide; on the remainder of the road earth shoulders were made. The macadam for the half mile at the north end was made sixteen feet wide and on the south half mile twelve feet wide.

The cross sections in Figure 21 show details of construction. It will readily be seen that the amount of work on this mile of road is considerably more than would be necessary on the ordinary country road with macadam twelve feet in width.

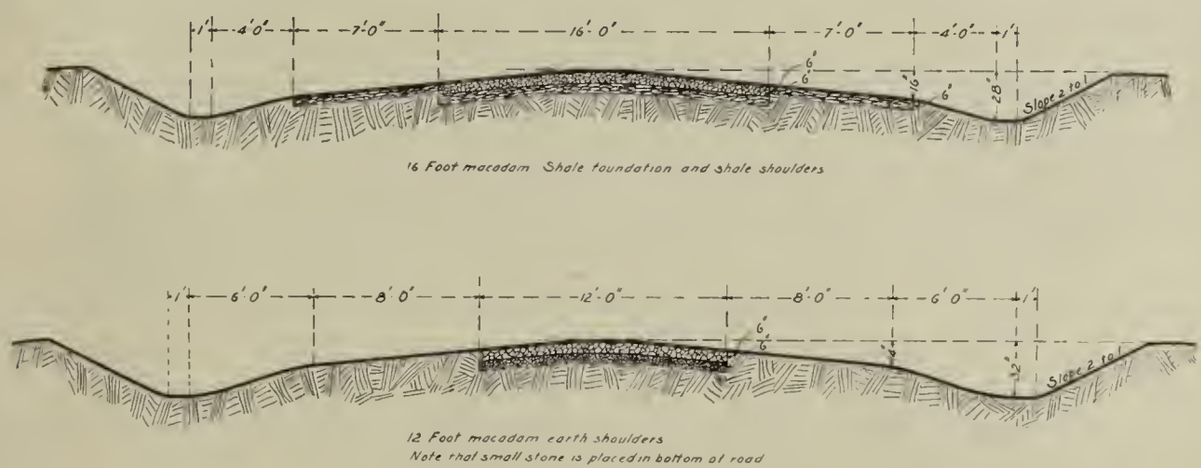


Fig. 21,

The cross section of a 16 foot macadam road with shale foundation and shale shoulders, and a 12 foot macadam with earth shoulders. Note the small stone is placed at the bottom of the road and that the 3 inch size forms the wearing surface.

Plate 7-B shows an inspection party during construction. Plate 8-A shows road at old culvert before the improvement. View B on Plate 8 is the road during construction at the same point. The shale subcourse is shown in the foreground. In the distance is the top course of the gravel section. These views look in opposite directions. Plate 9 shows a view at the south end of the road on Dec. 5 and a side road leading into it on the same day.

The following is a summary of the general conditions, amount of work and labor cost:

Length	5,200 feet
Width of macadam	12 and 16 feet
Square yards of macadam, all stone	5,133
Square yards of macadam, shale base	3,022
Square yards of shale shoulders	1,555
Average haul for stone	¾ mile
Average haul for shale	¼ mile
Cubic yards of stone in road	3,500
Cubic yards of shale in road	895
Cubic yards of shale in shoulders	465

Labor $1.75 per day for men.
$3.50 per day for two-horse team, nine-hour day.

Cost of—	
Excavation	$1,061 33
Laying tile drain	202 25
Shaping road bed	136 42
Unloading stone from cars	314 96
Hauling stone	600 48
Loading and hauling shale	461 02
Spreading stone	359 74
Spreading shale	78 00
Trimming shoulders	223 36
Rolling, sprinkling, coal, oil, etc	610 62
Superintendence, watchman, water boy, ice and drinking water	530 30
Total labor cost	$4,578 48

Unit Cost for Labor—		
Unloading stone	$0.09	per cu. yard
Hauling stone	0.172	per cu. yard
Spreading stone	0.103	per cu. yard
Loading and hauling shale	0.237	per cu. yard
Spreading shale	0.060	per cu. yard
Rolling and sprinkling	0.111	per cu. yard
Total labor cost placing stone	$0.476	per cu. yard
Total labor cost placing shale	$0.398	per cu. yard

McLean Road, Mt. Hope Township, McLean County.

This road extends one mile east from the village of McLean, which has a population of about 700. The citizens of McLean and residents along the road organized and appointed a committee to have general charge of the undertaking. They agreed to raise $2,000.00 or as much more as might be necessary to do all the work required. Material was shipped from Joliet and the freight paid in ballast, so that the only expense to the State Highway Commission for building this road was furnishing the steam roller and sprinkler and the supervision of the work. The road was built twelve feet wide. The earth shoulders were made about five feet wide; in some places wider, where the width of the road permitted. Two small concrete culverts were put in, replacing the old ones, which were found to be in poor condition.

The road was reported to be in the worst condition of any in the neighborhood during the winter and spring, and it was the desire of those interested to have it improved to see what success a macadam road would have under these conditions. A view of the finished road is shown on Plate 10-B.

The total labor cost of construction of this road, excluding the culverts, was $1,794.14. The total amount of material used was 2,962 cubic yards.

The general conditions, amount of work and labor cost are as follows:

Length	5,400 feet
Width of macadam	12 feet
Square yards of macadam	7,225
Average haul for stone	¾ mile
Cubic yards of stone in road	2,962

Labor $1.75 per day for men.
$3.00 per day for two-horse team, nine-hour day.

A. Experimental Road at Salem, Marion County. Limestone Macadam Road.

B. Experimental Road at McLean, McLean County, Limestone Macadam Road.

Cost of—	
Excavation	$111 20
Shaping road bed	205 55
Unloading stone from cars	225 14
Hauling stone	693 76
Spreading stone	116 90
Trimming shoulders	95 16
Rolling, coal, oil, etc	192 43
Superintendence	154 00
Total	$1,794 14

Unit Cost for Labor—	
Unloading stone	$0.076 per cu. yard
Hauling stone	0.234 per cu. yard
Spreading stone	0.039 per cu. yard
Rolling and sprinkling	0.065 per cu. yard
Total labor cost placing stone	$0.414 per cu. yard

Labor Cost per Sq. Yd. of Finished Macadam—	
Excavation	$0.015
Shaping road bed	0.031
Placing stone	0.166
Trimming shoulders	0.013
Superintendence	0.021
Total labor cost per sq. yd. of finished macadam	$0.246

Greenville Road, Central Township, Bond County.

The township commissioners and residents of Greenville proposed to pay for all labor necessary for the construction of a mile of macadam road running south from Greenville, and petitioned the State Highway Commission to furnish the material and superintend the construction. The commission considered this petition favorably and the construction was undertaken. Crushed stone was furnished from the penitentiary crusher at Menard.

The road is comparatively level and required only a small amount of grading for the road bed, which was made twelve feet wide, flanked on either side with shoulders six feet wide. The soil is a brownish yellow clay, which makes in wet weather deep, sticky, muddy roads. The total labor cost of the road was $2,028.50, and 3,372 cubic yards of stone were used, of which 174 cubic yards were piled along the road side for any small repairs that might be necessary in the spring.

The general conditions, amount of work and labor cost are as follows:

Length	5,300 feet
Width of macadam	12 feet
Square yards of macadam	7,066
Average haul for stone	½ mile
Cubic yards of stone in road	3,198

Labor, $1.75 for men. $3.50 per day for two-horse teams, nine hours.

Cost of—	
Excavation	$297 11
Shaping road bed	111 36
Unloading stone from cars	148 38
Hauling stone	806 48
Sreading stone	229 62
Trimming shoulders	70 79
Rolling, coal, oil, etc	112 76
Superintendence, watchman, water boy	252 00
Total labor cost	$2,028 50
Unit Cost for Labor—	
Unloading stone	$0.044 per cu. yard
Hauling stone	0.24 per cu. yard
Spreading stone	0.074 per cu. yard
Rolling	0.035 per cu. yard
Total labor cost of placing stone	$0.393 per cu. yard
Labor Cost per Sq. Yd. of Finished Macadam—	
Excavation	$0.042
Shaping road bed	0.016
Placing stone	0.172
Trimming shoulders	0.010
Superintendence, watchman, water boy	0.036
Total labor cost per sq. yd	$0.276

DeKalb Road, DeKalb Township, DeKalb County.

The experimental work done at DeKalb was conducted somewhat differently from that at other points. The DeKalb commissioners had already built one or two miles of macadam road in a very creditable manner and had at hand a roller and the necessary appliances for doing good work.

The first construction of macadam highways at DeKalb was done by the local commissioners in coöperation with the United States Office of Public Roads, who built an object lesson road on what is known as the South First street road. The length of the road built was 4,510 feet. The total labor cost, as reported by the commissioners, excluding all cost of material and also excluding the cost of culverts, was $3,030.22, or at the rate of $3,500.00 a mile. The width of the macadam was twelve feet; 2,040 yards of crushed stone were used and 200 yards of sand as binder, making a total of 2,240 yards in the road. The total cost, including materials, was $5,920.42, or $1.31 per foot. This road was built in 1904. The following year the commissioners built a piece of road 1,450 feet long and twelve feet wide on what is known as West Main street, with a total labor cost of $823.36, or at the rate of about $2,940.00 a mile. The total cost of this work, including materials, was $1,516.36, or $1.05 per lineal foot.

Early in the present season the DeKalb commissioners made an application to the State Highway Commission for 4,000 yards of crushed stone, stating that they had a steam roller and would construct a road according to modern methods, and that they would be willing to pay the freight.

The road selected was what is known as the Fourth street road. The macadam was laid about eleven feet wide on the average. Detailed instructions as to how the work should be done were given the commissioners. The State Highway Commission also furnished an extra roller. The immediate supervision was in charge of the local commissioners.

The chief difference between the construction of this road and the other roads that had been built at DeKalb was in the relative position of the large and the small stone. On the first roads constructed the small material was placed at the top, whereas on this work the one and one-half inch material was placed on the bottom of the road and the three-inch material on the top. This will result, as before explained, in a road that will wear much longer and give much better service.

The crushed stone was furnished from the Joliet Penitentiary and cost the local commissioners 50 cents per ton for freight. The items of cost on this road are given as reported by Mr. S. E. Bradt, treasurer of the Board of Highway Commissioners.

Length of road	5,310 feet
Width of macadam (average)	11 feet
Square yards of macadam	6,490
Average haul for stone	1½ miles
Cubic yards of stone in road	3,950
Labor, $2.00 per day for men, $4.00 per day for teams, ten hour-day. grading and shaping road bed and trimming shoulders	$ 677 20
Tiling and laying	319 95
Freight on stone at 50c per ton	1,844 21
Unloading stone	202 20
Hauling stone	1,126 80
Spreading stone	121 60
Rolling	211 26
Total	$4,503 22

Unit Cost for Labor—	
Unloading stone, per cubic yard	$0.068
Hauling stone	0.38
Spreading stone	0.041
Rolling	0.073
Total labor cost of placing stone, per cubic yard	$0.562
Labor Cost per Sq. Yd. of Finished Macadam—	
Excavation, shaping road bed, and trimming shoulders	$0.104
Placing stone	.25
Superintendence (included in above items not kept separate)	
Total labor cost per sq. yd	$0.354

The commissioners also began work on what is known as the North First street road and constructed 3,850 feet with macadam about ten feet wide. They expect to continue the construction of this road in the spring, extending it about 2,000 feet further. The total cost reported, including freight on material furnished by the State Highway Commission from Joliet, was $2,228.10, or at the rate of $3,050.00 per mile.

Work on this road was begun very late in the season and was somewhat hurried on this account. The longer time a macadam road can have to become compacted before it has to withstand the effects of the sticky mud which is tracked upon it, the less likely it will be to pick out.

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